SUBJECT: Safety Plan

PREPARED FOR: NRDA (Natural Resources Damage Assessment) Field Operations

REVISION: December 8, 2010

1. INTENT

1.1. The intent of this Field Safety Plan is to establish a structured process and disciplined approach to the mitigation of health, safety and environmental risks associated with our operations and activities. This safety plan applies to the Natural Resources Damage Assessment (NRDA) Team. This plan does not apply under the following situations:

- When water and air temperatures are both below 50 degrees Fahrenheit
- In air temperatures below 38 degrees Fahrenheit
- During small craft advisories
- When wind speeds exceed 25 knots
- Operations during dusk/evening
- In bad visibility and bad weather
- Offshore operations

If it is deemed necessary for operations to continue in any of the conditions outlined above, a separate job hazard evaluation must be approved and authorized by the NRDA On-Site Lead, BP-Cardno Entrix, applicable trustee representatives, the NRDA Safety Officer and NRDA Field Operations.

2. COMMUNICATIONS

2.1. A central responsible person not in the field should be aware of the daily plan, work locations, and team members for each team.

2.2. NRDA Field Teams will contact NRDA Operations (located at ICP New Orleans) as identified below to help ensure personnel accountability. Human Use field teams will report to Stratus Headquarters in Boulder, CO.

2.2.1. Departing for daily op area.

2.2.2. Mid day.

2.2.3. Termination of operations (e.g. transition to over-the-road vehicle and/or arrival place of lodging).

2.2.4. As soon as practical to report any health, safety, security, or environmental incident.

2.2.5. Using the 700mhz Radio and/or one of the following NRDA Ops contact numbers:

2.2.5.1. PRIMARY - NRDA Field Ops 504-303-2086/504-335-0863

2.2.5.2. SECONDARY – NRDA On-Site Lead 985-291-5186 (cell); noaa.mc252.nrdacoord@noaa.gov

2.2.5.3. For non-routine issues and the two above numbers can not be reached, CALL Nir Barnea (NOAA Safety) - 206-369-5015 [nir.barnea@noaa.gov] or Troy Baker (ARD SE Regional Manager) – 225 -326-9765 [troy.baker@noaa.gov].

2.3. NRDA Team Members at ICP New Orleans will update the Field Teams Status Display upon notification from a NRDA Field Team.

2.4. Each NRDA Field Team will be provided with a copy of this safety plan

3. MINIMUM EQUIPMENT/RESOURCES FOR NEARSHORE AND SHORE-BASED OPERATIONS

3.1. One primary form of communication directly to the non-field responsible person (i.e. Cell Phone, 700/800 MHz Radio, or equivalent).

3.2. Secondary form of communication capable of directly reaching rescue personal in case of an emergency (i.e. Cell Phone or Marine VHF, etc.)

3.3. Marine VHF is required for all vessel-based operations. All vessels must have a fixed mount (not handheld)VHF Marine radio on board. Handheld GPS

3.4. First Aid Kit

3.5. Foul Weather Gear (rain jacket/pants)

3.6. PFD, Float Coat, and/or Immersion Suit as appropriate to Job Hazard Analysis

3.7. Cold Weather Kit (Dry Bag, Emergency Blanket, Warm Blanket, Dry Cloths, and Hand/Feet Warmers)

4. VEHICLE SAFETY

4.1. Pre-Trip Plan (Maps, directions)

4.2. Seat Belt use is mandatory

4.3. Observe posted safety notifications and speed limits.

4.4. DRIVER - Cell phone use both hand-held and hands-free, texting, and e-mailing is prohibited while driving. If necessary, park in a safe location (off the road) and use while parked.

5. ACCIDENTS – INJURIES – SPILLS – NEAR MISSES

5.1. Accidents and injuries should first be reported to an entity that can provide emergency assistance, if needed (USCG, 911, etc.)

5.2. Accidents, injuries, spills or near misses should then be reported to NRDA Field Ops within 15 minutes.

5.3. As soon as practical (but generally within 1 hour) accidents, injuries, spills or near misses must be reported by the NRDA Field Ops to the NRDA On-Site Lead. Required documentation will be managed by the NRDA On-Site Lead with assistance by involved personnel. The NRDA On-Site Lead will notify appropriate Incident

Management Team personnel including the BP Safety Officer at the Incident Command Post.

5.4. The NRDA On-Site Lead will report accidents, injuries, spills, or near misses to the all relevant federal, state, contractor, and BP/Entrix managers by email as soon as practicable following the incident.

6. TRAINING

6.1. Any member of a NRDA Field Team is required to have the following Safety Training.

- Level I and II BP Safety Induction
- HAZWOPER Certification
- PHI Helicopter Pre-Flight Safety Briefing (if flying in helicopters)
- Heat stress and cold stress training/awareness

7. PERSONAL PROTECTIVE EQUIPMENT

7.1. NRDA Field Team members are expected to utilize Personal Protective Equipment for the activity being performed. A task requiring PPE shall not be performed unless PPE is used (refer to the Job Hazard Analysis incorporated with this document).

7.2. Staff must adhere to and follow pilot/captain/operators safety related instructions at all times. The NRDA On-Site Lead is responsible for directing team activities and will help decide if safety issues preclude scheduled activities. All team members are responsible for individual and collective safety.

8. PRE OPERATION MEETING (Tail Gate Meeting)

A daily pre-operations meeting will be conducted on-site with each team by the field team leader. Job Hazard Analysis' are located below. Specific topics of discussion will include:

- Lessons learned from the prior day's mission or other missions
- Current weather and short-term forecast
- PPE requirements
- Communications / Notification Requirements
- Food and Water
- Location of nearest treatment facility or hospital
- Potential hazards to watch out for
- Overall situational awareness

9. JOB HAZARD ANALYSIS (see following pages)

- Shore Operations
- Small Boat / Air Boat Operations
- Helicopter Operations
- Fixed Wing Operations for biological aerial surveys

- Fencing/Station marking operations
- Pom-pom inspections
- Chain drags
- Oyster sample collection
- Water quality testing
- Sampling in Phragmites
- Marine-based operations in cold weather

10. DWH NRDA SAFETY, COMMUNICATION, AND ACCOUNTABILITY CHECKLIST

Technical Working Group:_____ State:_____

Field Activity:_____

Number of Teams:_____ Persons p/Team:_____ Duration:_____

Activity Type (check as appropriate): ☐ Shore-based Activity (i.e. does not require boat/aircraft) ☐ Small Boat/Shore Activity (i.e. requires small boat transport to sampling location) ☐ Vessel-Based Activity	**Cell Phone Service Availability** (check as appropriate): ☐ Reliable cell phone service from ALL major providers, at all times. ☐ Reliable cell phone service from some providers at all times. ☐ Limited or no cell phone service at some times.
Access to Emergency Assistance (check as appropriate): ☐ Direct access to local EMS services within 15 minutes. ☐ Delayed access to local EMS services (15-45 minutes). ☐ EMS access requires vessel and/or air evacuation.	**Accountability System** ☐ NRDA ICP Houma Field Ops ☐ NRDA Offshore Cruises ☐ MC252 Air Ops ☐ Alternative System: Responsible Person: _____ 24hr Phone#:_____
Primary Form of Communication (check one or more): ☐ Cell-Phone ☐ Satellite Phone ☐ Two-way Radio System	**Secondary Form of Communication** (check as appropriate): ☐ Cell-Phone ☐ Satellite Phone ☐ Two-way Radio System ☐ Marine VHF ☐ EPRIB/PLB or SPOT Tracker
Additional Safety and Accountability Resources (check as appropriate): ☐ Directions to Medical Facilities / Staging Areas ☐ First Aid Kit ☐ Advanced First Aid Kit ☐ Medically Trained Personnel ☐ Handheld GPS	

TASK	**NRDA Shore Survey Operations**	**PERFORMED BY**	Caleb T. King (Coast Guard - Safety)
LOCATION	Various locations of affected areas	**REVIEWED BY**	Lisa DiPinto (NOAA - NRDA Coordinator)
DATE PREPARED	5/8/2010 New **X** Revised	**PPE REQUIREMENTS**	Personal Flotation Device (PFD) Safety Glasses or Goggles *(tinted as necessary)* Tyvek Coveralls and Boot Covering Nitrile Gloves

Issue of Concern / Activity	Potential Hazards	Control Measures
Entering / Departing Boat	Wet surfaces, change in stability	Watch where you step; use available handrails; assistance by others.
Walking Shore	Heat Stress	Stay hydrated and take breaks. Monitor each other. Know symptom of heat stress and how do address them.
	Sun Burn	Apply sunscreen to exposed skin. Wear a hat with a brim to shade face.
	Insect Bites / Stings	Use mosquito repellant; and maintain Sting Swabs in First Aid Kit.
	Eye strain (sun light)	Wear tinted eyewear.
	Animals (snakes, alligators, and other non-domestic types)	Careful placement of feet and hands; No open toed shoes.
	Fall Into Water	Wear Personal Flotation Device when 10-feet or closer to water.
	Loss of Communication	Establish and maintain communications with ICP Houma, other vessels, and never separate NRDA workers from vessel where communications cannot be maintained.
	Working alone	Maintain buddy system at all times, personnel should not work alone
Activity where Personal Contamination is Anticipated	Hand contamination and/or other exposed skin as well as clothing	Wear Tyvek (or similar) boot covering and coveralls; Nitrile gloves; Safety Glasses or Goggles depending on liquid splash potential.
Use of Tools	Cuts / Scrapes	Use tools as designed and refrain from over-exerting shovel tips where loss of control could happen.

TASK	**Small Boat / Air Boat Operations**	**PERFORMED BY**	Caleb T. King (Coast Guard - Safety)
LOCATION	Various locations of affected areas	**REVIEWED BY**	Lisa DiPinto (NOAA - NRDA Coordinator)
DATE PREPARED	5/8/2010 New [X] Revised [ ]	**PPE REQUIREMENTS**	Personal Flotation Device (PFD) Safety Glasses or Sun Glasses Hearing Protection

Issue of Concern / Activity	Potential Hazards	Control Measures
Entering / Departing Boat	Wet surfaces, change in stability	Watch where you step; use available handrails; assistance by others.
Vessel in Transit	Fall Overboard	Personal Flotation Device.
	No communication to/from vessel	All vessels must have a VHF Marine radio on board, permanently bolted to the structure
	Collision, Allision, or Grounding	Follow Navigational Rules of the Road; Maintain awareness; Know location; Maintain Communications.
	Overloading Vessel	Distribute weight evenly and do not exceed vessel capacity plate.
	Mechanical Issues	Keep spare parts, tools, etc. onboard and always know your fuel levels.
	Airborne Particulates and Insects	Wear safety glasses or safety goggles.
	Heat Stress	Stay hydrated and take breaks. Monitor each other. Know symptom of heat stress and how do address them.
	Sun Burn	Apply sunscreen to exposed skin. Wear a hat with a brim to shade face.
	Pinch Points	Maintain control of doors/hatches; Keep fingers and feet clear of lines/ropes
	Noise	Double hearing protection must be worn onboard air boats.

TASK	**Air Operations**	**PERFORMED BY**	Caleb T. King (Coast Guard - Safety)
LOCATION	Heliports and along affected areas	**REVIEWED BY**	Lisa DiPinto (NOAA - NRDA Coordinator)
DATE PREPARED	5/8/2010 New X Revised	**PPE REQUIREMENTS**	Hearing Protection Personal Flotation Device (PFD)

Issue of Concern / Activity	Potential Hazards	Control Measures
Boarding Helicopter	Noise, Tail Rotor, Rotor Wash	Hearing Protection, Never walk behind helicopter, keep all items secured
In Flight	Noise, Water Landing, Motion Sickness	Hearing Protection, PFD, Medication
Departing Helicopter	Noise, Tail Rotor, Rotor Wash	Hearing Protection, Never walk behind helicopter, keep all items secured

TASK	**Fencing/marking operations**	**PERFORMED BY**	Nir Barnea (Safety Officer)
LOCATION	Affected area	**REVIEWED BY**	
DATE PREPARED	11/22/2010 New [X] Revised [ ]	**PPE REQUIREMENTS**	• Work gloves • Goggles • Hearing Protection • Hard toe boots • Personal Flotation Device (PFD) if near water

Issue of Concern / Activity	Potential Hazards	Control Measures
Driving stakes in the ground	• Hand, finger and foot injury from hammer impact • Hand and finger injury from slivers and sharp stakes • Eye injury from flying particles • Hearing impact from excessive noise • Drowning if work is near water	**PPE:** Use gloves, goggles, hard toe boots, hearing protection, and PFD (when working near water) **Administrative:** • Do not perform work requiring PPE until PPE is available and used. • Ensure buddy system • Ensure communication is working and nearest clinic/hospital location is available

TASK	**Pom-Pom Inspection**	**PERFORMED BY**	Stephanie Fardy
LOCATION	Boat Launches/Marinas in Louisiana, Alabama, Mississippi and Florida	**REVIEWED BY**	Nir Barnea (Safety Officer)
DATE PREPARED	11/23/2010 New [X] Revised [ ]	**PPE REQUIREMENTS**	• Plate Glass in UV Box • Goggles (if plate glass is absent) • Nitrile Gloves

Issue of Concern / Activity	Potential Hazards	Control Measures
Pom-pom inspection under ultra violet light	• Skin irritation is possible if exposure occurs for long periods of time. • Eye inflammation and irritation is possible if looking directly at the source of radiation	**PPE:** Plate glass should be in place in the UV box. Goggles (or glasses) should be worn if plate glass is missing. Nitrile gloves should be worn when handling pom-poms. **Administrative:** • Do not perform work requiring PPE until PPE is available and used. • Ensure buddy system • Ensure communication is working and nearest clinic/hospital location is available

TASK	**Chain drags**
LOCATION	Nearshore locations in Louisiana, Mississippi, Alabama and Florida
DATE PREPARED	11/23/2010 New [X] Revised [ ]

PERFORMED BY	Stephanie Fardy
REVIEWED BY	Nir Barnea (Safety Officer)
PPE REQUIREMENTS	• Nitrile Gloves • Safety Glasses • PFDs

Issue of Concern / Activity	Potential Hazards	Control Measures
Lifting and handling the chains	• Back strain from handling chain with improper form • Hand contamination • Potential hand or finger injury if catches in the chain.	**PPE:** Nitrile gloves should be worn if there is potential for contamination when handling sentinels, pom-poms, chains and seawater and other materials. PFDs should be worn on the water **Administrative:** • Do not perform work requiring PPE until PPE is available and used. • Ensure buddy system • Ensure communication is working and nearest clinic/hospital location is available
Activity where Personal Contamination is Anticipated	Hand contamination and/or other exposed skin	Nitrile gloves; Safety Glasses or Goggles depending on liquid splash potential.

TASK	**Use of sharp objects (Scissors, wire cutters)**
LOCATION	Nearshore waters and shoreline from Louisiana to Florida
DATE PREPARED	11/23/2010 New [X] Revised [ ]

PERFORMED BY	Stephanie Fardy
REVIEWED BY	Nir Barnea (Safety Officer)
PPE REQUIREMENTS	• Kevlar work gloves • PFD (if on the water)

Issue of Concern / Activity	Potential Hazards	Control Measures
Use of sharp objects	• Cuts, scrape, etc.	**PPE:** Wear knit Kevlar work gloves when using sharp tools and a risk of cutting exists **Administrative:** • Do not perform work requiring PPE until PPE is available and used. • Ensure buddy system • Ensure communication is working and nearest clinic/hospital location is available

TASK	**Oyster sample collection**
LOCATION	Nearshore waters in Louisiana, Mississippi, Alabama and Florida
DATE PREPARED	11/23/2010 New [X] Revised [ ]

PERFORMED BY	Alāna Wilson
REVIEWED BY	Nir Barnea (Safety Officer)
PPE REQUIREMENTS	• Nitrile gloves • Knit Kevlar work gloves • PFD

Issue of Concern / Activity	Potential Hazards	Control Measures
Dredging	• Heavy lifting	**PPE:** • PFD (both on the water and when collecting samples from shore) **Administrative:** • Follow proper ergonomic behavior for heavy lifting • Do not perform work requiring PPE until PPE is available and used. • Ensure buddy system • Ensure communication is working and nearest clinic/hospital location is available
Collection of oyster samples (via dredge, quadrat or by hand)	• Contact with sharp objects • Slippery footing in intertidal zones	**PPE:** • Wear disposable knit Kevlar work gloves OVER nitrile gloves anytime handling sharp objects (e.g. oysters) • PFD (both on the water and when collecting samples from shore) • Waders, with proper grip for walking during intertidal sampling

TASK	**Water quality testing**
LOCATION	Nearshore waters in Louisiana, Mississippi, Alabama and Florida
DATE PREPARED	11/23/2010 New [X] Revised [ ]

PERFORMED BY	Alāna Wilson
REVIEWED BY	Nir Barnea (Safety Officer)
PPE REQUIREMENTS	• Nitrile gloves • Goggles to prevent eye contact with the calibration solution if splash occurs

Issue of Concern / Activity	Potential Hazards	Control Measures
Calibration of water quality meter	• Contact with calibration solution	**PPE:** Wear nitrile gloves and goggles when calibrating the water quality meters **Administrative:** • Include MSDS in meter kit
Measurement of water quality parameters	• Contact with potentially contaminated seawater	**PPE:** Wear nitrile gloves when handling the meter probe and when lowering it into or pulling it out of the water

TASK	**Sampling in Phragmites**	**PERFORMED BY**	Allan Hooker
LOCATION	Phragmites stands	**REVIEWED BY**	Nir Barnea (Safety Officer)
DATE PREPARED	12/04/2003 New [X] Revised [ ]	**PPE REQUIREMENTS**	• Kevlar gloves • Fully enclosed goggles • Full length, heavyweight shirt and pants • PFD (if on water)

Issue of Concern / Activity	Potential Hazards	Control Measures
Performing any work within Phragmites	• Eye injury • Skin punctures/abrasions • Drowning if work in near water	**PPE:** Kevlar gloves and full length shirt and pants should be worn to prevent skin punctures/abrasions. Fully enclosed goggles should be worn to protect the eyes. A PFD should be worn when working on or near the water. **Administrative:** • Only perform work if PPE is worn • Ensure buddy system • Ensure communication is working and nearest clinic/hospital location is available

TASK	**Marine-based Operations in Cold Weather**	**PERFORMED BY**	Stephanie Fardy
LOCATION	Throughout Louisiana, Mississippi, Alabama and Florida	**REVIEWED BY**	Nir Barnea (Safety Officer)
DATE PREPARED	12/06/2010 New [X] Revised [ ]	**PPE REQUIREMENTS**	• Float Coats • Warm clothing

Issue of Concern / Activity	Potential Hazards	Control Measures
Performing any marine based operations when water temperatures are below 60 degrees Fahrenheit.	• Cold Stress (Hypothermia, Frostbite, Trench Foot, Chilblain-Red, Surface Transportation and Icing)	**PPE:** Multiple layers of clothing should be worn and clothing to protect the hands, feet and head should be worn to minimize effects of the cold. A float coat must be worn when water temperatures are below 60 degrees at any time during operations. **Administrative:** • Only perform work if PPE is worn • Ensure buddy system • Ensure communication is working and nearest clinic/hospital location is available • Marine based operations must cease when air and water temperatures are both below 50 degrees Fahrenheit • No operations at night, in bad visibility, bad weather, when wind speed >25 knots, when small craft advisory issued • No operations on any vessel deemed unsafe for any reason or missing any necessary equipment such as VHF radio.

TASK	**Fill in general task**
LOCATION	Fill in location
DATE PREPARED	Xx/xx/xxxx New [X] Revised [ ]

PERFORMED BY	Fill in person performing hazard analysis
REVIEWED BY	Fill in person reviewing and approving
PPE REQUIREMENTS	• PPE 1 • PPE 2 • PPE 3

Issue of Concern / Activity	Potential Hazards	Control Measures
Fill in activity	• Hazard 1 • Hazard 2 • Hazard 3 • Etc.	**PPE:** Fill in specific PPE used **Administrative:** • Do not perform work requiring PPE until PPE is available and used. • Ensure buddy system • Ensure communication is working and nearest clinic/hospital location is available

MC 252 Standing Order		
TO: All Personnel assigned to MC252 Response		
FROM: Tad Lynch	POSITION: Houston IC Safety Officer	
SUBJECT: Incident Reporting	DATE: 02 May 2010	Time: 1630 hrs

1.0 PURPOSE AND SCOPE

The purpose of this Standing Order is to establish a consistent HSSE incident reporting process for MC252 response personnel. Response personnel include all Federal employees, BP employees, Contractors, Visitors, and other third parties. These minimum reporting requirements are for response operations and are not intended to replace site or project-specific incident and emergency response procedures and policies. The ultimate purpose is to enable and foster a culture of sharing and continuous improvement through identifying trends, special focus needs, case management, HSSE performance and sharing lessons learned.

2.0 RESPONSIBILITIES

All personnel involved in the MC 252 response who are personally involved in, or witness an incident or near miss; are required to immediately notify the person in charge or BP Supervisor who is responsible for the work being conducted. The person in charge or BP Supervisor is responsible for making timely notifications to the appropriate Incident Command or Unified Area Command - Safety Officer (currently Houma, Houston, Mobile, and Robert).

Robert SO (985) 709-5522 **Houma SO (985) 493-7812**
Houston SO (281) 366-6916 **Mobile SO (251) 445-8690**

3.0 NOTIFICATION REQUIREMENTS

Incident Classification	**Notification Time**
Major Incident (MIA), High Potential Incident (HiPo), or Loss of Primary Containment (Spills)	Immediately
Recordable Injuries (DAFWC / Restricted Duty /Medical Treatment), First Aids, or Near Miss	Within 2 hours

4.0 REPORTING STRUCTURE

Safety Officers and/or Health & Safety Unit Leaders are required to report all incidents and near misses to the Safety Officer in Robert, La. - **(985) 709-5522.** After verbal notification has been made, send written incident reports and associated documentation to *MC252Safety@bp.com*.

Input into Traction will be completed by an HSSE Technician in Houston. The Tech will access information via the above e-mail location.

NOTE: If you are a Safety Officer and are not on the MC252Safety@bp.com distribution list, contact the number above and they will submit your information to IT&S to get you set up.

5.0 REQUIRED INFORMATION

Instructions: The Initial Incident Report should be completed using the attached GoM Preliminary HSSE Incident Report "Short Form", or an equivalent contractor supplied form. At a minimum, information should include the following and sent to MC252Safety@bp.com.

C:\Documents and Settings\churchtr\My

Minimum information to include:

Report Date:
Date / Time Occurred:
Date / Time Reported:
Type of Incident: First Aid, Recordable, Near Miss, Spill, HIPO, MIA
Location (Circle One): Offshore or Onshore
Site / Vessel:
Company/Agency/Volunteer Group involved:
Event Description:
Completed by:
Contact Phone #:

6.0 INCIDENT INVESTIGATION

The level of investigation performed will depend on the actual and potential severity outcomes. The level of investigation and responsible organization are listed below.

Incident Classification	**Investigation Requirements**
Major Incident (MIA), High Potential Incident (HiPo), or Loss of Primary Containment (Spills)	Houston Safety Officer and Tim Church will determine level of investigation and team make-up.
Recordable Injuries (DAFWC / Restricted Duty /Medical Treatment),	Local investigation. One-page Lessons Learned document will be developed by Tim Church from local investigation report.
First Aids, or Near Miss	Local investigation. Incident report containing information outlined in Section 5.

7.0 HSSE PERFROMANCE SCORECARD

The Safety Officer in Robert will report incidents to the Unified Area Command BP Liaison and BP Aide de Camp. They will also update and distribute the HSSE Performance summary and scorecard daily by 1100 hrs. It is responsibility of each IC Safety Officer to distribute the information to appropriate command and planning staff.

Safety Officer Name:	Date:
Signature:	Approval Signature:

NOAA	WATER COLUMN PROFILING SERVICES	CSA

Plan for Adaptive Water Column NOAA-NRDA Sampling (PAWNNS)
Cruise Plan – HOS Davis

GOM BLOCK

MISSISSIPPI CANYON 252

PROJECT HSE PLAN

NOAA

CSA International, Inc. (CSA)

REVISION STATUS			APPROVAL		
Rev	**Date**	**Reason for Issue**	**Originator**	**Reviewed**	**Approved**
A	4-May-2010	Issued for Comment	L. Powell		
B	7-May-2010	Changed vessel	F. Ayer		
C	7-May-2010	Changed HSE Manager	F. Ayer		
D	14-June-2010	Format revision/additions	L. Powell		

Dist:	**Subject**	**HSE Management**				
As per page 2	**Activity:**	**Project HSE Plan**				
	Location:	**GOM Block MC252**				
		Location	Disc	Document Type	Sequence No	Rev
	Doc. No.					**4**

PARTY APPROVAL FOR USE IN OPERATIONS

Bureau Veritas Stephen C. Donham, CIH HSE Manager	CSA Lynwood Powell HSE Manager

Record of Document Issue

Name	Company / Department	Copy No.	Date
Digital and Paper Copies			
NOAA			
Dr. Yong Kim	Chief Scientist, NOAA		
Bureau Veritas			
Stephen C. Donham, CIH	HSE Manager		
CSA			
Fred Ayer	VP/Project Manager-Stuart, FL		
Bruce Graham	Project Senior Scientist-Field		
Lynwood Powell	HSE Manager-Stuart, FL		
Tony Wadley	Site Safety Coordinator-Field		
Frank Johnson	Operations Director-Field		
Terry Stevens	Operations Manager-Field		
Gordon Stevens	Operations Manager-Stuart, FL		

TABLE OF CONTENTS

1.0 INTRODUCTION

NOAA will conduct a Water Column Profiling Survey (WCPS) to measure dissolved-phase aromatic hydrocarbons and free oil droplets as a function of depth and location relative to the subsurface oil release in Mississippi Canyon Block 252 (**Figure 1**). The objective of the project is to collect data to calibrate 3-dimensional modeling of subsurface oil plume structure, fate, and transport.

Several support vessels are chartered to conduct the survey operations for this project. The survey will consist of performing water column profiles using a General Oceanics model 1018 Rosette Water Sampling system and hydrographic profiles using a Seabird SBE-19 Profiling Conductivity-Temperature-Depth (CTD) and a variety of other water column sensors (Deep LISST, Aquatracka and Acoustic Back Scaterring devices). In addition a ROV system will be used to collect sediment and water samples and record video at the seabed. The survey vessels will deploy all sampling equipment at predetermined locations using a-frame/davit and winch systems. Within MC Block 252, water depths are expected to be approximately 5,000ft.

This document represents CSA International, Inc. (CSA) health, safety, and environment (HSE) policies and procedures for the NOAA WCPS. CSA is responsible for the overall safety management of the survey program.

Marine sampling can be inherently hazardous, and proper precautions need to be taken. Precautions for general vessel safety and chemical hazards to be observed on all CSA surveys are discussed in this document. The physical hazards unique to sampling equipment and operations and sampling precautions are discussed. The Project Scientist and the Site Safety Coordinator are responsible for ensuring that CSA HSE policies and procedures are consistently followed and enforced. Sampling activities will be suspended if the safety of the work crew cannot be ensured. Due to safety considerations all operations will be conducted during daylight hours only.

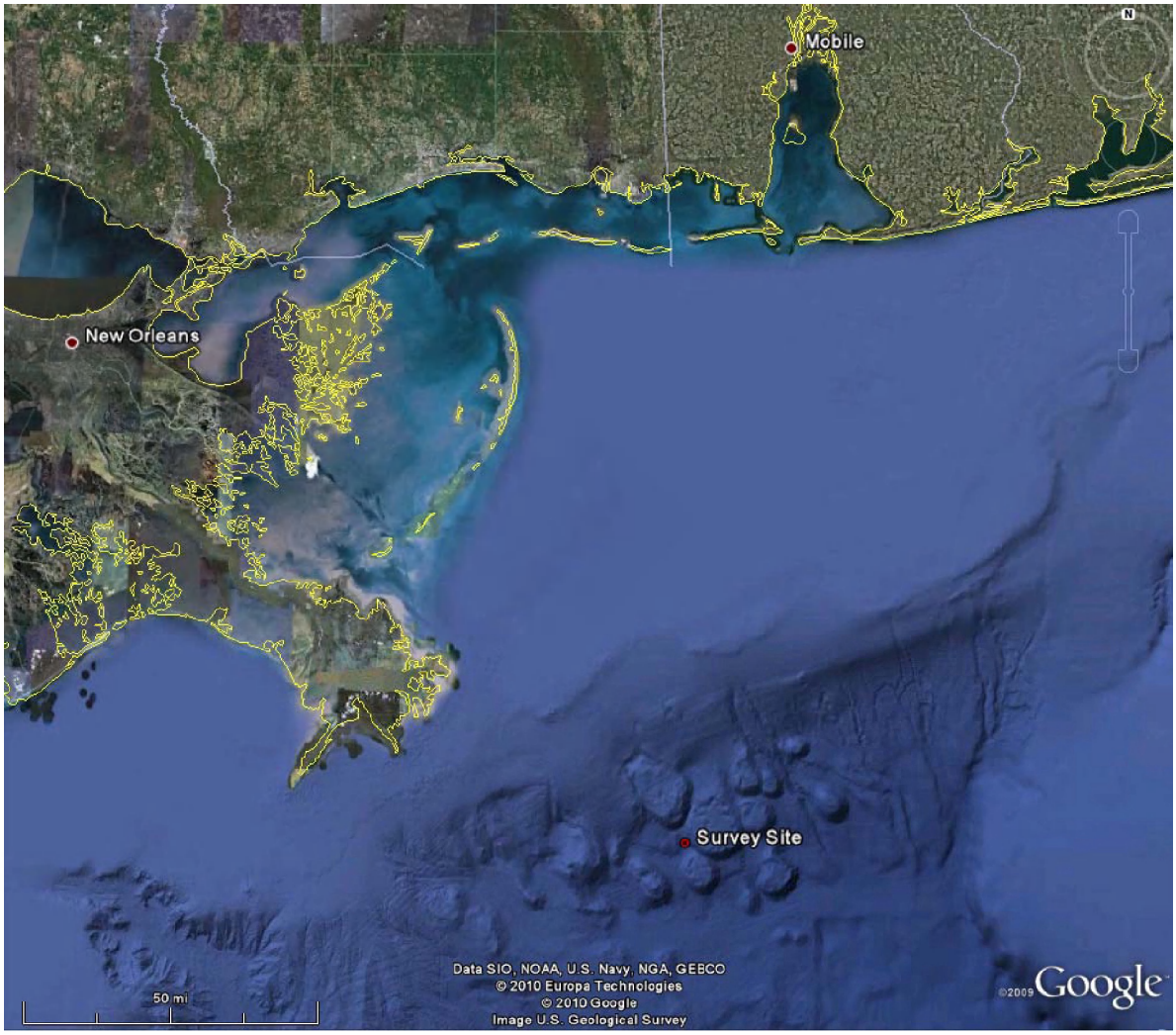


Figure 1. Location of Survey Site in Mississippi Canyon Block 252

1.1 General HSE Policy

This HSE Plan specifies the safety rules and standards for all CSA personnel and subcontractors during field onshore, shipboard, and laboratory activities. The HSE Plan is a tool to help implement and maintain the CSA safety policies and procedures.

1.1.1 CSA HSE Goals

The safety goal for CSA is to prevent all injuries, protect worker health, and cause no damage to the environment. CSA is vitally concerned for the health and safety of all its employees, subcontractors, facilities, and materials used during all phases of operations. We rely on each employee to actively support and implement the HSE policies and procedures. All CSA personnel are responsible for HSE compliance. The HSE policies are intended to create and maintain a safe working environment for all employees and protect the environment.

All employees and subcontractors are to be familiar with the client's HSE policies and work rules. In particular, all employees and subcontractors are to read from the client's corporate safety manuals all sections pertaining to:

- client sites that may be visited by CSA personnel during the conduct of CSA's work; and
- any activity which is procedurally similar to CSA's activities for the project.

PROJECT OPERATIONS WILL BE SHUT DOWN
IF SAFETY OF PERSONNEL CANNOT BE ASSURED

1.1.2 Site Safety Hazard Analysis and Risk Assessment

The Site Safety Coordinator will perform a site safety hazard/risk analysis as necessary for any special operations which might be required for this project. Safety procedures are routinely assessed for effectiveness specific to the project. The Site Safety Coordinator monitors safety procedures and evaluates them on a specific task by task basis. This information is relayed to the CSA Corporate Safety Supervisor and changes, if any, are made to further ensure personnel safety.

A project-specific Hazards Analysis/Risk Assessment is presented in **Appendix A**. **Table 1** provides the risk ranking descriptions. The HSE Risk Assessment was conducted for each potential hazard by ranking the consequence of the hazard and likelihood of the hazard occurring as summarized in **Table 2**.

Table 1. Risk ranking descriptions.

Risk Ranking	Description
A	Broadly acceptable
B	Tolerable
C	Subject to further study; identification of risk reduction measures and Cost Benefit Analysis
D	Subject to further study; identification of risk reduction measures and Cost Benefit Analysis
E	Unacceptable

Table 2. Risk matrix.

Likelihood of Occurrence		Consequence of Hazard				
		1	8	16	50	100
		Minor	Moderate	Major	Critical	Catastrophic
0.5	Insignificant	A (0.5)	A (4)	B (8)	B (25)	C (50)
1	Remote	A (1)	B (8)	B (16)	C (50)	D (100)
2	Infrequent	A (2)	B (16)	C (32)	D (100)	D (200)
5	Occasional	A (5)	C (40)	C (80)	D (250)	E (500)
10	Frequent	B (10)	C (80)	D (160)	E (500)	E (1,000)

1.1.3 Deviation from Safety Standards

Any deviation from the standard safety requirements as outlined in this HSE Plan and the client's particular Corporate Safety Manual shall be registered by the Site Safety Coordinator with the appropriate feedback from personnel. Follow-up by the Site Safety Coordinator requires reporting any deviations to the CSA Corporate Safety Supervisor.

1.1.4 Management of Change

If for any reason there is a request to make changes, the following will apply: The NOAA Representative will be notified of any changes to material, equipment, personnel, or procedures that could affect the safety of the operation or materially affect the scope or completion of the work.

Changes to any aspect of the work program will be subject to a risk assessment by CSA and NOAA to ensure any potential adverse effects of the change may be identified and either eliminated or controlled to minimize risk as much as reasonably practicable. Proposed changes will require the approval of the CSA Project Manager (or a designated representative) and the NOAA Technical Representative prior to implementation. Any such changes or additions to the operation and the subsequent risk assessment will be communicated prior to implementation to all relevant personnel likely to be affected by the change.

Any implemented change will be documented by completing a CSA Management of Change Order (See **Appendix C-Forms**).

2.0 LINE MANAGEMENT

Line management personnel outlined in each specific Survey Plan

2.1 Site Safety Coordinator

A Site Safety Coordinator will be designated for each survey. His/Her role in the project includes the following:

- HAZWOPER/CPR/First Aid trained;
- Ensures that first aid supplies are in good order and easily accessible;
- Conducts pre-mobilization safety briefing;
- Conducts daily safety/tool box meetings at the beginning of each day and notifies the client representative if any conditions or specific health and safety hazards will be encountered during the work to be done during the day;
- Responsible for ensuring all safety rules are followed and understood;
- Understands that if unsafe conditions exist, personnel are not required to work; and
- Will not rush to complete a job at the expense of safety.

2.2 Project Scientist/QA Coordinator

A Project Scientist/QA Coordinator will be designated for each survey. His/Her role in the project includes the following:

- Responsible for data collection and quality;
- First line of incident reporting;
- Coordinates daily survey progress assessment meetings;
- Responsible for reporting and recording all injuries, accidents, and near misses to the designated client representative on board and to the CSA home offices. The initial report will be oral, which will then be followed by a written record; and
- HAZWOPER/CPR/First Aid trained

2.3 Operations Manager

An Operations Manager will be designated for each survey. His/Her role in the project includes the following:

- Coordinates with Project Scientist on overall survey goals;
- Coordinates operations with ship's crew;
- Responsible for equipment installation and operation;
- Responsible for daily operations of sampling equipment; and
- HAZWOPER/CPR/First Aid trained.

2.4 Lead Technician

A Lead Technician will be designated for each survey. His/Her role in the project includes the following:

- Insure all sampling equipment is in proper working order;
- Inspects CSA equipment daily to ensure it is in proper working order;
- Assist in sample/data collection and processing;
- Responsible for implementing safety procedures; and
- HAZWOPER/CPR/First Aid trained.

**EACH EMPLOYEE IS RESPONSIBLE FOR HIS OWN AND OTHERS' SAFETY.
HE ALSO HAS AN OBLIGATION TO WORK SAFELY AND REPORT ANY UNSAFE CONDITIONS.**

3.0 HAZARD COMMUNICATION

3.1 General

All employees and contract personnel are informed of all potential health and safety hazards related to the project and are instructed on how to avoid the risk of an accident. When operating offshore CSA personnel will conduct daily meetings and communicate progress with onshore support. Personnel to relay program status and any logistical concerns and requirements via SAT Phone email.

3.2 Reporting

All survey personnel will be provided with sampling guides that summarize sample collection and processing activities and identify potential hazards.

In the event of an injury accident the Site Safety Coordinator initially will notify the Project Manager and/or Project Director and the client or its agent verbally. An Incident/Accident Notification form will be completed within 24 hours of an accident/injury/near miss and a copy will be sent to the CSA HSE Manager. "Incident/Accident Notification" forms (**Appendix C**) will be kept on site.

A daily progress report will be prepared for the HSE manager and will detail the technical aspects of the sampling acquisition as well as details and will include the following:

- Close calls/near misses;
- Any unsafe condition;
- Any CSA employee having a problem working safely;
- Any accident/incident;
- Any failure of safety equipment;
- Hazard reports & safety observations;
- Inspections & audits completed;
- Emergency drills completed;
- Personnel on Board;
- HSE issues or concerns; and
- Interaction with other vessels and fishermen

3.3 Project Site

Mobilization/Demobilization: Golden Meadow & Houma, Louisiana
Survey Site: GOM Block MC252
Schedule and Duration: Varies
Weather: Monitored and assessed daily

3.3.1 General Vessel Safety

To ensure adequate preparation for emergencies that may possibly arise, prior to selecting and/or chartering a vessel for survey operations, the Site Safety Coordinator will ensure that the proper safety equipment are or will be available when the vessel is mobilized for a survey. If any equipment are not available (e.g., in foreign countries where vessels of opportunity are used) arrangements should be made

to have the safety equipment made available either from in-country sources or by shipping them to the mobilization port.

3.3.2 Pre-Mobilization Safety Briefing (PMSB)

A Pre-mobilization Safety Briefing will be conducted by the CSA Site Safety Coordinator and the NOAA HSE Manager.

The following list is a summary of items to be discussed:
1. Description of project and goals
2. Communications – key to acquiring goals
3. Team members, assignments, and shifts
4. Coordination with ship's crew
5. Designation of person in charge on deck
6. Complexity of the operations – moving platform, machinery, openings
7. Pre-operation checks – vessel preparation
8. Safety equipment – vessel and sampling
9. Hazards - vessel and equipment – Hazid Actions/JSA/Toolbox
10. Limitations of personnel and equipment (Lifting, rigging, and safe working loads)
11. Environmental conditions (wind, weather, sea state, etc.)

An HSE induction for all personnel involved with the offshore field survey will be conducted by CSA prior to or during vessel mobilization.

All vessel crew members will be briefed on the operation of all primary sampling equipment, ROV systems, winches, blocks, cables, davits, a-frames, and other survey support equipment.

It is the responsibility of the Site Safety Coordinator and survey team members to ensure that proper rigging and lifting procedures are used.

The vessel's captain will be responsible for conducting the following drills: M.O.B., Fire, Abandon Ship, and Medical Emergency. These drills will be conducted once before the survey begins and weekly thereafter.

3.3.3 Chemical Hazards

Isopropyl Alcohol, Hexane, Acetone, and Liquinox are some of the chemicals which may be used during the field surveys. Additionally there may be personnel conducting surveys in areas where the oil spill dispersant COREXIT EC9500A has been used. Material Safety Data Sheets (MSDS) for each chemical product, including COREXIT EC9500A, will be aboard the vessel located near the chemicals and on the bridge. All personnel will be aware of the chemical products being used and safety considerations needed to prevent injuries.

The Site Safety Coordinator will ensure that field personnel review all relevant Material Safety Data Sheets (MSDS) before mobilizing for a field survey.

It is the responsibility of all personnel on board to take advantage of the information available, to wear the protective equipment provided, and to follow recommendations for handling any hazardous material.

Protective safety equipment will be worn when handling hazardous chemicals and include: chemical-resistant gloves, laboratory aprons, safety glasses or goggles, masks, and/or respirators.

In some areas, contact with marine sediment may present a potential health hazard from chemical and/or biological constituents of the sediment. Possible routes of exposure to chemical/biological hazards include inhalation, skin and/or mucous membrane absorption, ingestion, and injection. Potentially hazardous chemical/biological sediment constituents may include hydrogen sulfide, mercury and other heavy metals, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, solvents, and various types of bacteria and viruses. Other potentially hazardous substances may include chemicals used as sample preservative agents or sampler decontamination agents.

Crew members should exercise caution to avoid coming into contact with potentially contaminated sediment and water during sampling operations. Crew members should exercise good personal hygiene after sampling and prior to eating or drinking.

Exposure to airborne contaminants and the oil spill dispersant COREXIT EC9500A can be greatly reduced if the vessel steams to windward in a way that minimizes risk to the sampling crew from exposure to volatiles. Having respirators on hand will reduce exposure to volatile fumes that may be present when mixing large quantities of chemicals or using a solvent rinse during equipment decontamination.

During sampling caution, common sense, and good judgment should dictate appropriate safety gear to be worn in any given situation on deck. Hardhats, gloves, and steel-toed shoes must be worn in working conditions where there is a possibility of injury to the head, hands, or feet. Work vests must be worn at all times while working on the deck area. If in doubt, survey team members should ask the designated Site Safety Coordinator.

Collecting samples in extremely hot and humid weather carries the risk of dehydration and heat stroke. Survey team members should carry an adequate supply of potable water or other liquids for protection against dehydration in hot weather. The Site Safety Coordinator will ensure that survey team members continually drink to replace lost fluids in periods of work in hot weather. All survey vessels will provide adequate liquids for all survey team members.

3.4 Areas of Safety Concern

3.4.1 Mobilization

There is a large variety of marine sampling equipment in use today, and each has the potential for causing serious injury. Many types are heavy, ranging from under 50 lbs for a small sediment grab or plankton net to up to 2,000 lbs for a large Ewing piston corer. Unless the equipment is secure on deck or fully deployed and submerged, care must be taken to avoid crushing or other impact-related injuries from the handling of this gear.

This project will use a large ROV to collect all chemical and infaunal samples. The ROV is very heavy and all personnel must be aware of the corer weight and potential for uncontrolled motions during deployment and recovery. Proper tag line procedures will be stressed during the pre-mobilization briefing. Work gloves will be worn at all times when using tag lines.

Also, an appreciable amount of vertical clearance is usually required to clear the gunwale during sampling instrument deployment and retrieval, which in turn can increase the risk of uncontrolled lateral motion unless suitable tag lines are used.

A typical box corer is fairly heavy (from 200 to 900 lbs) and is also both tall and wide at the base. At least 100 square feet of deck area is required to safely manage this equipment. Good foot protection is mandatory when handling this equipment.

Essentially all types of sediment grabs utilize their own weight, some type of tensioning device, or other form of mechanical advantage to actuate the sampler upon contact with the bottom. Care must therefore be taken to minimize the risk of accidental or premature closure while handling. The box corer for this project has a release which triggers upon contact with the bottom. The sample is collected during retrieval.

In general, all sampling equipment uses the same type of marine hardware to attach to the appropriate lifting device. Periodically, all connections (e.g., cabling, shackles, pins, swivels, etc.) should be inspected to ensure the integrity of all points along the sampling assembly. The placement of the survey equipment on the deck will be discussed with the captain to assure safety and structural concerns are addressed. Welders attaching equipment to the vessel need to be certified in the operation of the welding and cutting equipment as well as using the appropriate materials to secure the equipment to the vessel. Tag lines will be attached to all equipment when it is being placed on or removed from the vessel.

Concern: Lifting equipment onto vessel.
Precaution(s): Lift with legs, back straight, good footing, and avoid twisting. Get help if load is too heavy. Avoid pushing, pulling, or prying while working aloft. Approved hard hats and safety boots/shoes with toe protection should be worn while working on the fantail.

Concern: Slippery deck.
Precaution(s): Guard rails; shoes, boots with sufficient anti-skid soles to minimize potential for slippage; employees to wear personal floatation device (PFD) while on the work deck at sea and if transfers are required.

Concern: Installation of equipment.
Precaution(s): Secure all equipment in case of rough seas. In the case of installation of navigational antenna and cables, two people will be on hand at all times for this part of the mobilization and will inform vessel captain of antenna installation and positioning and have the radar unit switched off (antennae should not be moving).

Concern: Loose containers.
Precaution(s): Secure all shipping containers to ensure they cannot break loose and cause physical harm during rough sea condition.

Concern: Confined space.
Precaution(s): Keep clean and ventilated. Check for proper lighting. Conform to vessel permit to work and confined space entry requirements

Concern: Lock out/tag out procedures (faulty equipment).
Precaution(s): Unplug equipment before doing repair and tag it as such. Reactivate the system only through an established and published procedure that ensures each person has removed his own lock and tag first.

Concern: Installation of first aid kit.
Precaution(s): Ensure all personnel are aware of the location of the first aid kit on the vessel.

Concern: Location of fire extinguishers.
Precaution(s): Ensure all personnel are aware of the location of the fire extinguishers on the vessel.

3.4.2 Offshore

A sampling device is least secure while suspended in the air during the transitional period between the deck of a vessel and the surface of the water; a pitching and/or rolling deck during rough weather will

aggravate this situation. Care must be taken to ensure that sufficient restraining, or tag lines or other devices are in place to meet these conditions. Because of the increased potential for damage or injury, all personnel on deck and in the wheelhouse must be notified before a sampling device leaves the deck during deployment or breaks the surface upon retrieval. If the winch operator is remotely located from the scene of operations, a clear system of signals must be established between the lead deck person and the winch operator, usually via hand signals or electronic communication.

OSHA requires that hard hats be worn when working beneath suspended equipment, or when the potential of injury to the head exists due to lateral impact. All crew members should have a suitable level of seamanship skills, based upon their level of responsibility. Listed below are some of the items related to seamanship and gear-handling that, when overlooked, have been known to cause serious accidents on board ship.

- A capstan is potentially more dangerous than a winch drum, as the wraps are not enclosed and could instantly slip off the end if not handled properly.
- If a hydraulic hose fails, winches can free-wheel, and load-bearing rams can collapse under a load unless backed up with balance-check valves.
- Different kinds of line and wire rope have different characteristics, which may not be suitable for all applications (e.g., nylon is 25 percent stronger than polypropylene, but it is much more elastic and can be lethal if parted under a strain; polypropylene will float, making it less susceptible to propeller entanglement).
- An eye splice over a thimble will only cause a 5 percent reduction in line strength, but a knot (depending on type) can reduce the strength in a line by as much as 55 percent due to unequal strain on the fibers (a line will usually break under a strain at that point where it is forced to bend).
- Theoretically, the longer a line under a strain, the weaker it is when compared against its rated breaking strength (the chances are statistically greater of encountering a section weaker than the last as line length increases).
- The recommended working load-to-breaking strain for wire rope and line is typically 1 to 5. If the load ever exceeds 75 percent of the breaking strength, permanent damage could result, which can lead to unexpected breakage.
- Topside operations may be more dangerous on larger ships than smaller vessels because it is harder to keep track of safety concerns when activities are spread over a larger area of deck.
- Crew members should always stand clear of slack or looped line lying on deck to avoid entanglement. A sudden strain on slack line can entrap arms and legs; personnel may be severely injured or carried overboard.

In the event the sediment grab or winch wire becomes entangled in an object on the bottom, in the ship's propellers, or as a result of a malfunction in the winch or a-frame, the personnel on the bridge will be notified immediately.

The Operations Manager conducting sampling operations will confer with the ship's master and will direct the survey team members and vessel personnel in order that the situation is safely resolved.

Inclement weather may introduce additional hazards. Heavy equipment can be much more difficult to manage, and footing may become unsure due to slippery decks and/or increased vessel motion, and the risk of falling overboard may increase. Some state agencies requires that all railings be a minimum of 36 inches in height, and OSHA requires that an approved life vest be donned when working over the water or if there is an increased risk of falling overboard. A safety line will be secured across the opening from which the survey equipment will be deployed and retrieved. Vessel accommodations should be able to provide relief to crew members in case of cold or heat stress.

The vessel's Captain is responsible for determining the relative safety due to inclement weather on all operations. If necessary, survey operations will be suspended. The Captain will decide whether to stay on station or transit to port until weather conditions improve. If operations are suspended the Operations Manager will direct the movement and securing of equipment and materials until sampling resumes.

Concern: Chemicals.
Precaution(s): Familiarization with use and handling of chemicals to be used on project. Splash-proof goggles, organic vapor masks, and protective gloves will be used when handling chemicals. Chemicals will only be used in well-ventilated areas.

Concern: Acids, bases, and other hazardous chemicals.
Precaution(s): Briefing and MSDS sheets regarding all hazardous chemicals. Use of rubber gloves when handling dangerous chemicals such as water quality fixatives. Availability of first aid kits, eye wash kits, and spill kits. Prior to applicable activities, the Site Safety Coordinator will remind survey team members of the location of first aid kits, eye wash kits, and spill kits.

Precautions should be taken when handling hazardous materials during sampling and sample processing. Gloves and safety glasses should be worn as needed.

Concern: Man overboard.
Precaution(s): Single (one) employee is not allowed on rear deck of the vessel alone – two men or more are required on deck during at-sea operations. All employees are to wear PFDs while on deck of the vessel.

3.4.3 Winch and Davit Operations and Safety Procedures

CSA will be utilizing the services of subcontracted vessel operators who will provide suitable vessels to facilitate the sampling effort. An a-frame/davit will serve as the deployment/retrieval system for the rosette water sampler. The a-frame/davit is welded to the gunwale and deck and is constructed to safely handle any loads anticipated for the field survey tasks. The winch will be the CSA deepwater electro-hydraulic unit manufactured by Sea-Mac.

CSA is responsible for training field personnel in the safe working procedures of the equipment being utilized for this project. Under the terms of the contract, CSA and subcontracted vessel operators will provide competent personnel to carry out the work. As such CSA and subcontracted vessel operators will address the a-frame/davit, and winch systems which include electro-hydraulic winches and hydraulic power units (HPU). The purpose of this document is to outline a systematic approach to mobilization, training, and standards which will optimize safety and program efficiency.

Systems safety and operational planning and implementation are a two-tier function:

1. Pre-cruise planning will address the specific operational requirements associated with the equipment. It is the responsibility of the Operations Manager to ensure that all requirements relative to mobilization, operation, and maintenance are implemented through in-house planning and discussion.

2. On-board, prior to the actual operation, it is the Operations Managers responsibility to coordinate mobilization, training, and operational procedures with the vessel's Captain and crew, CSA Technicians, Project Scientists, and Operations group. This is to ensure that all individuals involved clearly understand what is required of them and that all equipment is appropriate and have been inspected.

The following points will be addressed during the Pre-mobilization Safety Briefing and Operations Training:

- Read all warning tag information and become familiar with all controls before operating winch.
- Never attempt to clean, oil, or perform any maintenance on a machine with the engine or prime mover running, unless instructed to do so.
- Never operate winch controls unless you are properly positioned at the operator's station and you are sure personnel are clear of the work area.
- Assure that personnel who are responsible for hand signals are clearly visible and that the signals to be used are thoroughly understood by everyone.
- Ground personnel should stay in view of the operator and clear of winch drum. Do not allow ground personnel near winch line under tension. A safe distance of at least 1-1/2 times the length of the unspooled cable should be maintained.
- Inspect rigging and winch at the beginning of each work shift. Defects should be corrected immediately.
- Keep equipment in good operating condition.
- Do not exceed the maximum pressure, PSI (kPa), or flow, GPM (LPM), stated in the winch specifications for hydraulically driven winches.
- Match winch line speeds to job conditions.
- Leather gloves should be used when handling winch cable.
- Never attempt to handle winch cable when the hook end is not free. Keep all parts of body and clothing clear of cable rollers, cable entry area of fairleads and the winch drum.
- When winding winch cable on the winch drum, never attempt to maintain tension by allowing winch cable to slip through hands. Always use "hand-over-hand" techniques, being careful to keep hands and clothing away from winch drum and fairlead rollers.
- Never use winch cable with broken strands. Replace winch cable.
- Do not weld on any part of the winch.
- Use recommended hydraulic oil and gear lubricant.
- Install guarding to prevent personnel from getting any part of body or clothing caught at a point where the cable is wrapped onto the drum or drawn through guide rollers.
- Install switches or valves which will shut off power to the winch in locations where they can be reached by anyone entangled in the cable before being drawn into the winch or any "pinch-point."
- "Deadman" controls, which automatically shut off power to the winch whenever the operator leaves his station, should be installed whenever practical.
- Never allow anyone to stand under a suspended load.
- Avoid sudden "shock" loads or attempting to "jerk" load free. This type of operation may cause heavy loads in excess of rated capacity, which may result in failure of cable and winch.
- It is imperative that the person operating the unit follow directions while maintaining situational awareness for the task at hand.

Never put your hands into, around, or near the spool or rollers when operating.
Serious injury can occur!

3.4.4 Demobilization

At the completion of all planned survey tasks there can exist the opportunity for injury due to survey team members and ships crew rushing demobilization efforts. When these demobilization procedures are performed too quickly the risk of an accident is increased.

3.4.4.1 Offshore

Concern: Personnel anxious to disembark vessel.
Precaution(s): Must use cautious, methodical procedures.

Concern: Loose trash/debris.
Precaution(s): All trash/debris will be stored and removed.

Concern: Transferring equipment/personnel from vessel to dock. Dropped objects
Precaution(s): PFDs required (see also slippery deck hazard).

3.4.4.2 Onshore

Concern: Personnel anxious to disembark.
Precaution(s): Must use cautious, methodical procedures.

Concern: Loose trash/debris.
Precaution(s): All trash/debris will be stored and removed.

Concern: Safe disposal of trash, hazardous chemicals, fixatives, etc.
Precaution(s): Careful identification, marking, disposal, packing, and transport (if required) of hazardous materials. Proper neutralization of chemicals will be completed if required.

Concern: Leakage of sample preservatives (i.e. formaldehyde).
Precautions: Briefing on safe handling of formaldehyde and other possible fixatives. Double bagging of fixed samples, eyewash capabilities, flushing of neutralization of skin contact.

3.5 Emergency Program

The vessel master has a direct responsibility for the health, safety and welfare of all persons on board and for dealing with the immediate response to emergencies. In the event of an emergency CSA will provide emergency response management in cooperation with the vessel's captain to insure the health, safety, and welfare of all persons on board. The Site Safety Coordinator will work along side the captain in the event of a medical emergency.

In the event of injury or illness to personnel, CSA have responsibility for the evacuation of any person on board from the vessel to the nearest port or heliport, depending upon the nature and severity of injuries. From there CSA have responsibility to transfer their own and subcontractor personnel to hospital for treatment. NOAA has responsibility for the transfer, hospitalization and ongoing welfare of their own personnel. CSA and their subcontractors have full responsibility for the response to and management of all emergencies arising onboard or involving the vessel.

CSA will mobilize a First Aid Kit for each survey. All CSA personnel are trained in First Aid administration.

3.5.1 Personnel on Board (POB)/Next of Kin (NOK)

A POB/NOK list for the vessel shall be issued prior to departure from the harbor and will be updated should personnel change out, which is not currently planned. Copies of the vessel POB/NOK lists will be transmitted to CSA and NOAA offices. All parties will undertake to keep the NOK information confidential.

In the event of an emergency, CSA where necessary shall liaise with the relevant authorities and provide a verified POB list. The onshore response personnel of CSA (and 3rd party contractors if necessary), will

be responsible for providing support to relatives of CSA personnel and subcontractors on board during an emergency. The NOAA response team would take this responsibility for NOAA vessel personnel.

Prior to vessel mobilization medical evacuation support services were researched in south Louisiana. A hospital and helicopter service, identified prior to mobilization, will be contacted in the event of an emergency.

3.5.2 Overall Strategy

An emergency is defined as an unplanned event, or situation, which poses an actual or potential threat to the safety or integrity of:

- Life and limb or health of personnel on board the vessel
- The environment or,
- The reputation of CSA or NOAA

An emergency can be further defined as any event, incident or situation, which poses a continuing threat and requires the mobilization of assistance or support from sources external to the affected party.

Both offshore and onshore emergency response actions will be clear, co-coordinated and will be based on the agreed arrangements listed in this document.

CSA emergency response team will take the lead role in responding to all emergencies.

Local services will respond in an emergency to provide support to CSA. Depending upon the nature and scale of the emergency, the CSA shore support may also respond.

In event of an emergency, a number of CSA personnel will remain on call for the duration of the NOAA contract. CSA will have a team on standby in Florida to provide support, consisting of the CSA HSE Manager, an Operations Manager, and other support personnel as required.

Vessel

The vessel captain and the CSA Site Safety Coordinator in cooperation with the NOAA HSE field representative will insure Muster, Fire, MOB, loss of power, and Communication drills will be run before beginning field tasks. The Fire drill will include pressure to and discharge of the fire hoses.

3.5.3 Post Event Incident Reporting

Formal written reports will be prepared by CSA after an emergency has been resolved. A report need not be final, but may be an interim or preliminary document. A report should not only identify the sequence of events and causes of the incident, but also the adequacy of the response and corrective actions.

3.5.4 Emergency Response

Responsibilities during an emergency include the following:

Offshore Response

Vessel Master	
Responsibility:	Safety of all persons on board the vessel Overall control of the vessel Emergency Response Team On-scene commander Liaison with other vessels if in the survey area Obtaining medical advice as required
Actions:	Controlling emergency and safeguarding personnel Notify the relevant authorities, if necessary Notify CSA On-Duty Operations Notify the NOAA representative on the vessel Calling onshore medical authorities
NOAA HSE Representative	
Responsibility:	Providing assistance to the Vessel Master as requested Initial notification of NOAA HSE Manager
Actions:	Call duty person as above and inform them of nature of emergency and onshore assistance if required.

Local Onshore Response

CSA Project Manager	
Responsibility:	Primacy for supporting the vessel and coordinating the onshore emergency response in accordance with CSA Emergency Response procedures.
Actions:	Coordination of emergency response via the existing CSA emergency response organization and arrangements, including provision of logistical support Notification of and Liaison with external agencies including Medical Support Notification and regular updating of NOAA representative. Informing CSA personnel and subcontractor NOK of injuries etc. Arranging medivacs to shore in response to injuries, illness or other incidents on board for all POB. Arranging reception and transfer to hospital for any injured CSA or subcontractor personnel
NOAA HSE Manager	
Responsibility:	The health, safety and welfare of NOAA personnel involved in any emergency, once they have returned to shore. The reputation and standing of NOAA
Actions:	Mobilize to NOAA offices in response to call out from NOAA Survey Rep. Keep updated of events via CSA emergency personnel Make arrangements to meet and greet any injured or affected NOAA personnel in port or heliport as required Arrange transfer and hospitalization of injured NOAA personnel as required Arrange for medivacs as required for NOAA personnel Ensure notification of NOK for any affected NOAA personnel. Seek support on preparation and issue of media statements as required, in conjunction with CSA.

3.5.5 Emergency Response Organization

The response organization for the baseline environmental survey is shown in **Figure 2** below. Call out and communication routes are also shown in this figure.

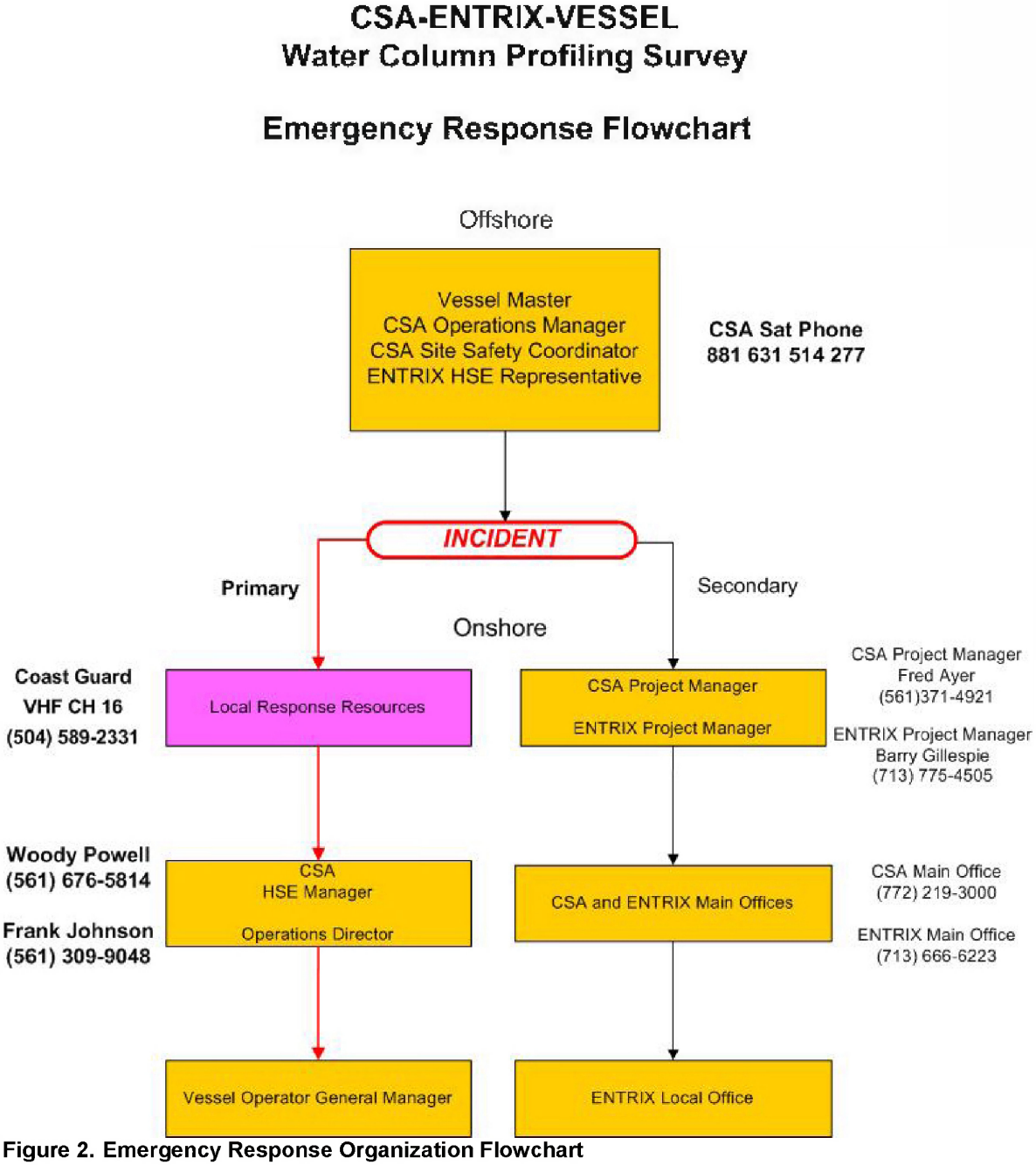


Figure 2. Emergency Response Organization Flowchart

3.5.6 Medivac Plan

Should a medical emergency require the immediate evacuation of a person or persons from the survey vessel, the vessel should immediately head toward the nearest shore facility. The Coast Guard should be contacted immediately on VHF channel 16. The Coast Guard air station is located approximately 13 miles south of New Orleans in Belle Chasse, La

Any applicable client transport coordinators or helicopter dispatchers should be contacted by either satellite phone or cellular telephone for assistance with the emergency. They will arrange helicopter evacuation of the injured person(s) from the platform or shore facility to the nearest emergency medical facility. If medical treatment is needed for a non-life threatening situation, the vessel should head to the nearest shore facility from which the injured person(s) can then travel to the nearest medical facility to obtain necessary medical treatment.

The arrangements listed in this document shall apply to the Emergency Response Procedures for the period that the vessel is contracted for the purpose of completing the survey.

Emergency contact numbers for communications during emergency situations are provided below.

Vessel Emergency Contact Numbers

Vessel	
Master	Will be provided for each vessel
Satellite Phone	985 520-4376
Vessel Call Sign	Will be provided for each vessel
Vessel Manager	Will be provided for each vessel

CSA Emergency Contact Numbers

CSA	
Satellite Phone-OnBoard Vessel	**985 520-4376**
Fred Ayer, CSA Project Manager	+1 772-219-3039 (Office) +1 561-371-4921 (Mobile)
Gordon Stevens, CSA Operations	+1 772-219-3076 (Office) +1 407-310-3053 (Mobile)
Lynwood Powell, HSE Manager	+1 772-219-3040 (Office) +1 561-676-5814 (Mobile)

NOAA Emergency Contact Numbers

NOAA
Jenna Cragan 401 316-5600

4.0 MEDICAL/FIRST AID PROGRAM

CSA personnel are all properly trained in cardio-pulmonary resuscitation (CPR) and first aid. Training allows CSA personnel to give immediate and temporary care to a victim of an accident or sudden illness until a physician can be obtained. This effective first aid consists of common sense, training, and knowledge of the following:

- Procedures for treating bleeding;
- Procedures for heart attack victims;
- Procedures for choking victims;
- Procedures for treating victims of burns;
- Procedures for treating electric shock victims;
- Procedures for treating victims of exposure to chemicals;
- Procedures for treating victims of inhalation of toxic gas or smoke;
- Procedures for treating shock victims;
- Procedures for treating victims of heat exhaustion;
- Procedures for treating victims of heat stroke;
- Procedures for treating victims of frostbite;
- Procedures for treating victims of hyperthermia; and
- Procedures for treating victims of skin poisoning or swallowed poisons.

5.0 SUBSTANCE ABUSE PROGRAM

CSA is committed to maintaining a drug-free workplace. In recognition of the dangers to our employees and the company of drug abuse in the workplace, and pursuant to the provisions of the U.S. Drug-Free Workplace Act of 1988 and Federal Acquisition Regulation 23.504, all employees are subject to the following:

- Unlawfully manufacturing, distributing, dispensing, possessing, or using a controlled substance is prohibited in the workplace.
- Any employee who unlawfully manufactures, distributes, dispenses, possesses or uses a controlled substance in the workplace will be subject to discipline up to and including dismissal.
- All employees, as a condition of continued employment, must abide by the statement and are required to notify the company of any criminal drug statute conviction for a violation occurring in the workplace no later than five days after such conviction.
- This Drug-Free Workplace Statement does not amend, limit, restrict, modify or otherwise alter any other company rules, regulations, procedures or policies.

CSA employees tested for substance abuse must meet the U.S. Department of Transportation (DOT) standards for drug and alcohol testing to be able to work as CSA's representatives on designated projects. The medical forms may be made available for the client's inspection with prior approval from the employee.

DOT regulations require screening for the following drugs (known as the NIDA 5 Panel):

- Marijuana;
- Barbiturates;
- Opiates;
- Amphetamines;
- PCP; and
- Cocaine.

6.0 PERSONAL PROTECTIVE EQUIPMENT SAFETY PROGRAM

The following outlines CSA policy pertaining to the issuance and use of certain personal protective equipment (PPE) that will be issued by CSA. Each employee will be responsible for ensuring his PPE is kept clean and in good working condition.

Protective gear for sampling personnel should include the following:

- a hard hat;
- steel-toe shoe/boots;
- work vest;
- equipment handling and chemical-resistant gloves (e.g., leather or Nitrile);
- safety glasses/goggles;
- respiratory protection;
- rain gear (if necessary);
- coldwater survival gear (if necessary); and
- hearing protection (if safe noise levels are exceeded).

In addition to the above PPE personnel deploying and retrieving equipment over the side of the vessel will be required to wear a safety harness and utilize a retractable lifeline securely connected to a point on the vessel.

It is important to note that the ship's captain has the ultimate responsibility and authority to immediately override the authority of all other on board personnel, especially where the general welfare of crew and vessel are concerned.

During the dockside mobilization, the Site Safety Coordinator will conduct an inventory of the safety-related equipment and materials and provide a report to the Project Scientist and Operation Manager of their status, location, and availability.

Hard Hats. Each employee will be expected to wear a hard hat at all times when working out on deck. These safety hats will meet the specifications contained in American National Standards Institute, Z89.1-1969, Safety Requirements for Industrial Head Protection.

Steel-toed Shoes/Boots. Steel-toed shoes or boots will be required while outside of office area or on any work site, e.g., work deck.

Gloves – Work and Chemical. Work gloves will be provided for handling of equipment and supplies to reduce the potential of hand injuries. Nitrile, rubber, gloves will be provided for the handling of all chemicals and solvents.

Safety Glasses/Goggles. All employees will be issued and must wear approved safety glasses with side shields at all times while in the work area. Those employees who wear prescription glasses will wear safety glasses over their glasses. This also applies to those employees who wear contact lenses.

All employees will be issued and expected to wear 1) approved impact-type goggles with side shields when engaging in any activity that involves hazards to the unprotected eye from chipped or flying particles; and 2) approved splash proof goggles when they are handling hazardous chemical liquids, powders, or vapors as well as when they are in the vicinity of these chemicals.

Employees who wear prescription glasses will wear goggles over their glasses. This also applies to employees who wear contact lenses; these employees must make it apparent that they do wear contact lenses.

Respiratory masks
Protective respiratory mask will be provided to all employees. Any employee handling chemicals or solvents is required to wear a respiratory mask in addition to gloves and goggles.

Protective Outerwear
An outerwear capable of protecting the employee from oily products will be worn during all sampling operations. A Tyvek or suitable alternative is required.

Rain gear
Rain gear is not provided for most offshore surveys. It is the responsibility of the employee to provide adequate protection when working outside of the confines of the vessel.

Cold water survival gear
Cold water survival gear will not be necessary for this survey due to the time of year and the location of the survey area.

Hearing protection
Hearing protection is mandatory in all designated high noise areas. Ear plugs and ear muffs will be provided.

During operations which require special equipment and outerwear, the previously mentioned mandatory equipment and requirements pertaining to the equipment may be voided or amended.

7.0 HEARING CONSERVATION PROGRAM

All employees will wear the appropriate hearing protection provided by CSA while in a high noise area (85 decibels [dBA] or above for an 8-hour time period). A sign will be posted in high noise areas.

The Site Safety Coordinator will ensure any employees working in a high noise area are wearing hearing protection.

CSA also urges its employees to use common sense in a "noisy environment." If it is necessary to shout to communicate, an area is considered a high noise area whether or not signs are posted.

8.0 LIFE SAVING EQUIPMENT

All personnel working or riding on the deck of a boat or barge, or when transferring between vessels or onto a platform, must wear a U.S. Coast Guard (USCG)-approved PFD with reflector tape strips. There will be one PFD for each employee. On-board personnel should familiarize themselves with the ship's man overboard procedures and the vessel's life saving equipment location.

9.0 MOB AND FIRE EMERGENCY PROCEDURES

9.1 MAN OVERBOARD

- Throw a ring buoy overboard as close to the person as possible.
- Notify the personnel on the bridge immediately; bridge records vessel position.
- Post a lookout to keep the person overboard in sight.
- Maneuver the vessel to pick up the person in the water.
- Crew member wearing a PFD attaches a safety line and stands by to jump into the water to assist the person overboard if necessary.
- If person is not immediately located, notify Coast Guard and other vessels in the area by radio telephone.
- Continue search until released by the Coast Guard.

9.2 RULES FOR ABANDONMENT

- Review rules posted on vessel prior to vessel leaving dock.
- Take instructions from vessel's captain and proceed to pre-assigned station on the vessel.

9.3 FIRE ON BOARD

- Review rules posted on vessel prior to vessel leaving dock.
- When alarm sounds proceed to pre-assigned station on the vessel.
- Vessel's captain will instruct survey team members.

10.0 WATER SURVIVAL PLAN

All employees must become familiar with the use and operation of survival gear and emergency instructions posted on the vessel.

In case of vessel evacuation:

1. Put on a PFD and remove your safety hat.
2. Do not dive into the water but jump in feet first.
3. If swimming in rough water, turn your back to the wind or waves. Keep your head out of water and use a breast stroke.
4. If there is an oil or fuel fire on the water, swim UNDER the water. Before surfacing, use your hands to splash a breathing hole above your head. Close your eyes before surfacing, take a breath, and then resubmerge (feet first).
5. If there is oil and/or debris on the water surface, keep your head up and out of the water. Push the oil/debris away from you as you swim. Protect eyes, nose, and mouth.
6. If swimming in cold water, conserve body heat, and help to prevent hypothermia by minimizing movement.
7. Do not swim to rescuers – let them come to you.

CONSERVE YOUR ENERGY! YOUR SURVIVAL MAY DEPEND ON IT!

11.0 EQUIPMENT INSPECTION PROGRAM

CSA will insure the following equipment is aboard the vessel:

- Fire extinguishers;
- PFDs;
- Safety Harnesses;
- Retractable lifelines;
- Ear protectors;
- Hard hats;
- Safety glasses;
- Safety shoes;
- Organic vapor masks; and
- Protective gloves.

The above equipment shall be inspected daily prior to use for wear and tear and so noted by the designated CSA safety person in his Project Log. During daily inspections, emphasis will be put on equipment security (i.e., safely secured for rough seas), and equipment maintenance.

The safety person will be knowledgeable with U.S. 29 CFR 1926 (Subparts E, F, I, J, K, L, N, and O): Personal Protective and Life Saving Equipment; Fire Protection and Prevention; Tools (Hand/Power); Welding and Cutting; Electrical; Ladders and Scaffolding; Cranes, Derricks, Hoists, Elevators, and Conveyors; Motor Vehicles, Mechanized Equipment, and Marine Operations.

12.0 ELECTRICAL SAFETY PROGRAM

12.1 INSTALLATION AND MAINTENANCE OF ELECTRICAL EQUIPMENT

All installation and maintenance of electrical equipment must comply with the pertinent provisions of the national electrical code. All electrical work will be performed by competent personnel who are familiar with code requirements and qualified for the class of work to be performed. All applicable electrical wire, apparatus, and equipment will be of a type approved by Underwriters Laboratories, Inc., Factory Mutual Engineering Corp., or any other nationally recognized testing laboratory.

12.2 ELECTRICAL ACCIDENT PREVENTION PROCEDURES

The best qualified available employee will be appointed to be the electrical job supervisor. That person will have total responsibility for the electrical work.

Each job should be thoroughly planned, making sure that adequate and proper equipment and sufficient personnel are available to perform the job safely. No job is to be rushed to completion at the expense of safety.

A special safety meeting will be conducted before starting a job to brief all workers involved to make sure all questions are answered and that no confusion exists among the workers.

All possible circuits in the vicinity of the work area should be de-energized and secured in this condition by grounding, locking, and tagging. If it is not possible to de-energize all circuits, use barriers, rubber goods, or any other protective equipment necessary to make the work area safe. Danger signs will be displayed in appropriate locations and on associated equipment as required to afford maximum personnel protection.

Complete attention should be devoted to the job at hand. Preoccupation or day-dreaming cannot be tolerated while working with electrical equipment.

Even low voltage (e.g., 32 volts AC) as well as many battery-powered systems are hazardous and require proper precautions.

All unsafe electrical equipment should be de-energized immediately and tagged "unsafe for use." This action and also notification of inoperable or damaged electrical tools, appliances, etc., should be reported to the immediate supervisor at once. Unqualified persons should not attempt to repair such equipment.

Under no circumstances should the hand or finger be used to test for voltage in a circuit. Only proper and safe test instruments should be used.

In case of an accident or an electrical fire, all power should be cut off immediately. Emergency switches are generally installed at convenient locations to stop electrical machinery. Know where these switches are. Use only fire extinguishers which have been approved for use on an electrical fire. Foamite or other conductive fluids, including water, must not be used on an electrical fire under any circumstances.

Electrical work of any kind will not be performed if an electrical storm is in progress in the immediate vicinity.

Adverse conditions such as darkness, poor weather, isolation, or any abnormal situations may make working alone unduly hazardous. These occasions should be identified by established management guidelines from which the employee can carefully assess the task to be performed and determine whatever assistance might be necessary to perform the job safely. All electrical conductors and equipment will be approved and meet the standards in 29 CFR Subpart K covering the electrical equipment and work practices for this project (copy follows).

13.0 SPILL PREVENTIVE/CLEANUP PLAN

All personnel involved on a project should be aware of all possible polluting situations and take steps to prevent such occurrences.

CSA Operations Managers will insure the MARPOL rules and regulations are posted on the vessel and are followed by all members of the survey team.

Should a spill occur, the following will be available:

- Absorbent pads for use on local spills on vessel and, if necessary, small discharges into the water;
- Absorbent booms for installation around drums and apparatus that could cause a spill on vessel;
- Should portable generators/winches be used that involve fueling, a catchment tray will be provided to prevent gasoline/oil or other fluids from being spilled;
- Shore personnel to locate suitable disposal container close to dock for trash removal from vessel; and
- Trash bags and ties for general trash storage will be provided on vessel.

In case of large spills, the vessel is to cease operations, stay in the area and call in to the local client base, local Coast Guard, or other appropriate regulatory agency.

PICK UP ANY TRASH YOU SEE -- NOT JUST YOUR OWN.
AND REMEMBER NO TRASH/DEBRIS/WASTE/POLLUTANT IS TO BE DEPOSITED ANYWHERE BUT IN THE CORRECT RECEPTACLE.

14.0 SHORT-TERM EMPLOYEE PROGRAM

Any CSA employees that have been with the company less than six months will be identified as "Short-Term Employees" to all personnel including the client or its agent prior to start-up and mobilization of project.

Short-term employees will be given a job-specific orientation prior to the general job safety meeting dealing with the client's site safety expectations and procedures and hands-on training by CSA for upcoming job assignments.

Short-term employees will expect to be given special supervision during their 90-day probationary period with the orientation reinforced at the end of their first week's employment with CSA and at the end of their first month's employment. The employee will then be evaluated by their supervisor monthly for the next three months. It is implied here and to be understood by the short-term employee that he will be teamed with an experienced employee whenever possible. Under no circumstances will two short-term employees be teamed on a job without approval.

APPENDIX

APPENDIX A

Hazards Analysis/Risk Assessment

HAZARDS ANALYSIS/RISK ASSESSMENT

Hazard	Consequences/Risk	Severity	Safeguard(s)/Control Measure(s)	Risk Matrix		Recommendations	Responsibility	Status
				Likelihood	Risk Rank			
Lifting accidents, dropped equipment	Injuries, damage to or loss of equipment/material	Major	Lifting procedures, lift plan, worker awareness, qualified/experienced personnel	Remote	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Boarding/loading boats	Trips, falls, injuries, damage to or loss of equipment	Minor	Designated boarding/ loading areas and procedures, first aid, clear work procedures	Infrequent	A	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Navigation and positioning control	Wrong locations, work delays, impact to work productivity	Moderate	Obtain latest nautical charts, set up and check CSA vessel GPS navigation during mobilization, prepare pre-plots, provide accurate locations, provide coordinates in a digital exchange file	Remote	B	Confirm accuracy of coordinates through backup GPS	Project Scientist	Open
Deployment/handling of sample collection equipment	Pinching injury, impact/crushing injury, entanglement, MOB	Moderate	Worker training, established procedures, work gloves, HSE briefing	Infrequent	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Man overboard (MOB)	Loss of personnel	Major	PFDs, work deck rules, safety chain, MOB procedures	Infrequent	C	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
General health and safety (offshore/on water)	Heat exhaustion and overheating, exposure, dehydration, minor injuries	Moderate	Adequate drinking water available, sunscreen, light clothing, clear decks, designated work areas and clear work procedures, first aid	Infrequent	B	Review during HSE induction	Operations Supervisor	Open
Spillage of fuels, oils, and lubricants	Environmental degradation, regulatory fines, damage to reputation	Major	Refueling on land or in port only, adequate capacity for full-day operations	Infrequent	C	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
General health and safety (onshore)	Exposure, dehydration, minor injury	Moderate	Adequate shade, adequate drinking water available, sunscreen, light clothing, clear/designated work areas, clear work procedures, work breaks	Infrequent	B	Review during HSE induction	Operations Supervisor	Open
Road/driving accidents	Collisions, damage to vehicles or equipment, injury	Major	Use of licensed and experienced drivers, safe driving at posted speeds, seatbelts	Remote	B	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Food-/water-/blood-borne pathogens	Debilitating illness, impacts to productivity	Moderate	Worker training, HSE briefing, emergency response plan	Infrequent	B	Review during HSE induction	Operations Supervisor	Open

Hazard	Consequences/Risk	Severity	Safeguard(s)/Control Measure(s)	Risk Matrix		Recommendations	Responsibility	Status
				Likelihood	Risk Rank			
Unsafe weather/sea state conditions	Damage to vessels	Major	Weather forecast reviews, continuous monitoring of local weather, ongoing communications, delay/cancel/abort weather thresholds	Remote	B	Conduct continuous monitoring of weather while on site, morning forecast reviews and postpone mobilization if predicted to exceed limitations	Operations Supervisor	Open
Rough sea conditions	Injuries, MOB, damage to or loss of equipment/materials	Moderate	Check for secure deck and equipment/materials before getting underway, use of PFDs	Infrequent	B	Cross check for clear deck prior to getting underway	Operations Supervisor	Open
Vessel mechanical failure or damage	Loss of vessel, vessel adrift, stranded divers	Major	Rigorous vessel maintenance and inspection, standby vessel, float plan, established communications	Remote	B	Ensure valid vessel inspections, pre-day vessel checklists	Vessel Master	Open
Unsafe deck conditions (e.g., wet, cluttered)	Slips, trips, falls, MOB, damage to equipment	Major	Clear decks, designated work areas, clear work procedures, emergency response plan	Frequent	D	Review procedures and PPE requirements in toolbox meeting prior to activity; install safety line across stern	Vessel Master	Open
Underwater obstructions, contact with bottom, grounding	Damage to seabed features/organisms, damage to boats/ equipment, injuries	Major	Review of nautical charts, mapping of navigation hazards, experienced boat operators	Remote	B	Review transit route for obstructions, shallow water	Vessel Master	Open
Other vessel/traffic shipping	Collisions	Major	Deck watch	Remote	B	Review of shipping patterns, contact any vessels in vicinity	Vessel Master	Open
Medical emergencies (injured/unconscious worker), limited timely medical access/support	Lack of/late medical attention leading to medical complications, possibly disablement/ fatality	Major	Emergency procedures for worker extraction, established communications to shore, standby vessel, local emergency support, emergency response plan, emergency oxygen on-board, comprehensive first aid equipment	Remote	B	Prior arrangements with Port/ambulance, advice to Navy and/or Coast Guard; post-emergency contact infomation readily available on all vessels/boats	Operations Supervisor	Open
Emergency preparedness	Inadequate response to emergencies	Minor	Conduct weekly drills, HSE inspection to review emergency systems	Infrequent	A	Review procedures in toolbox meeting prior to activity	Operations Supervisor	Open
Confined Space Entry	Loss of consciousness, fatality, impact to work productivity	Major	Real-time air monitoring, forced air ventilation, full body harness, rescue tri-pod	Remote	B	Review procedures in toolbox meeting prior to activity	Site Safety Officer	Open

APPENDIX B

MSDS for Project chemicals

Project Chemicals:

Liquinox

Isopropyl Alcohol

Hexane

COREXIT EC9500A

APPENDIX C

FORMS

Pre-Mobilization Safety Briefing

HSE Indoctrination Record

Job Safety Hazard Analysis

Hazard Analysis/Risk Assessment Acknowledgement

Daily Safety Meeting

Incident/Accident Notification

Next of Kin Information

Daily Survey Report

Management of Change Order

CSA INTERNATIONAL, INC.
PRE-MOBILIZATION SAFETY BRIEFING (PMSB)

A PMSB will be conducted by the CSA Site Safety Coordinator

The following is a summary of items to be discussed:

1) Description of project and goals
   - Sediment & Water collection, hydrographic profiler casts, ADCP, ROV Ops
2) Communications – key to acquiring goals
   - Accident prevention - safe and healthy environment
3) Team members, assignments, and shifts
   - CSA, NOAA, and vessel crew
4) Coordination with boat driver/vessel's crew
   - Efficient procedures
   - Emergencies - medical, fire, man overboard (MOB), abandon ship
5) Designation of person in charge on deck
   - Shift leader
6) Complexity of the operations
   - Mobilization, Field, Demobilization
   - Collection Processes
7) Pre-operation checks
   - Vessel preparation
   - Location of vessel safety equipment
8) Safety equipment
   - Vessel
   - Sampling
   - First-aid
9) Hazards
   - Vessel operations
   - Sampling operations
   - Vessel and equipment: slips, trips, falls, bumps, pinching;
10) Limitations of personnel and equipment
    - Lifting, rigging, and safe working loads
    - Personal protective equipment
11) Environmental conditions
    - Wind, sea state, etc.

The PMSB/HSE induction for all personnel involved with the field activities will be conducted prior to vessel mobilization. Daily briefings will be conducted for survey personnel. All vessel crew members will be briefed on the operation of all primary and support equipment and primary sampling equipment (especially the winch, blocks, cable, and A-frame) prior to mobilization. It is the responsibility of the survey team members to ensure that proper rigging and lifting procedures are used. The vessels' Masters will be responsible for conducting the following drills: MOB, fire, abandon ship, and medical emergency. These drills will be conducted once before the survey begins and weekly thereafter.

CSA INTERNATIONAL, INC.

HEALTH, SAFETY, AND ENVIRONMENTAL INDOCTRINATION RECORD

Name:

Date:

Employer:

I have received indoctrination and training for following:

1. Company safety policies of CSA, NOAA, and vessel safety requirements and the names of persons assigned to safety supervision duties.
2. Requirements and my individual responsibilities for accident prevention, maintaining a safe and healthy work environment, preventing damage to property, and protecting safety of others.
3. Provisions for medical facilities and procedures for reporting or correcting unsafe conditions and practices, and reporting accidents.
4. Job hazards and means used to control or eliminate those hazards, including applicable "Job Safety Analyses (JSA)" (major activity, locations, hazards, controls).
5. Accident Reporting - Both my individual and my Supervisor's responsibilities for reporting all accidents, even minor.
6. Sanitation - Water, toilet facilities.
7. Medical Facilities - Location of nearest medical emergency facilities, emergency phone numbers, first-aid kits and material data safety sheets.
8. Emergency Plans – man overboard, fire, medical, severe weather, spill response, and other emergency procedures.
9. Personal protective equipment.
10. Daily housekeeping requirements.
11. Fire prevention.
12. Policy on use of ropes, slings, and chains.

13. Hazards of floor and wall openings.
14. Hearing protection.
15. Requirements when working around hot substances.
16. Precautions with welding, cutting, and grounding of machinery.
17. Temporary electrical requirements.
18. Proper use of hand tools and power tools.
19. Proper precautions with compressed gas cylinders.
20. Requirements for ramps, runways, platforms, and scaffolds.
21. Clear access and ladder safety.
22. Material handling, storage, and disposal.
23. Hazardous materials.
24. If I am injured I (do) (do not) want the following person notified:

Name:

Phone:

Signature: _____ Date _____

Safety Officer Signature: _____ Date _____

CSA INTERNATIONAL, INC.

JOB SAFETY HAZARD ANALYSIS FORM

JOB TITLE:	JSHA No.____	Page___of___	DATE: New___ Revised___
Employer: Facility: Location:	Classification(s) Doing Job: Supervisor:	Required /Recommended Personal Protective Equipment:	Analysis by: Reviewed by: Approved by:

Sequence of Basic Job Steps	Potential Hazards	Recommended Action or Procedure

CSA INTERNATIONAL, INC.

HAZARDS ANALYSIS/RISK ASSESSMENT ACKNOWLEDGEMENT

My supervisor has reviewed this hazard analysis with me, and I understand the hazards and required precautionary actions. I will follow the requirements of this hazard analysis or notify my supervisor if I am unable to do so. I understand that there are Environmental, Safety, and Health professionals on staff if I need further assistance or clarification.

Name (please print)	Signature	Date

CSA INTERNATIONAL, INC.

DAILY SAFETY MEETING FORM

DATE:_____

PROJECT TITLE:_____

CONDUCTED BY:_____

IN ATTENDANCE: **Print Name** **Sign Name**

SUBJECT(S) DISCUSSED: **Potential Safety Hazards and Resolutions**

INCIDENT/ACCIDENT NOTIFICATION FORM Directions for filling out form

Email within 24 hrs to – Lynwood Powell, CSA Stuart Office – lpowell@conshelf.com

Originators Reference No: *Number assigned by project/asset as in its incident summary*		
Date of Incident:	**Time:**	**Exact Location**: **Location of the incident/Project Group**
Name of Person(s) involved: *Injured party, any other people involved*		
Employing Company: *Injured party and all people involved*		
Type of Incident: *LTI, Near Miss, RWC, Medical Treatment, etc.*		
Initial Potential Consequence: *Assign initial potential consequence as per The Risk Assessment Matrix*		
Description of Incident:	Where, when, what, how, who, operation in progress at the time (only factual)	
Provide details of the incident including: - *timing,* - *order of events,* - *Personnel involved their position, company, etc.* - *their role in the incident,* - *any relevant information available at the time of reporting* - *medical/emergency response details* - *any other important information*		

Immediate Action:	Immediate remedial action and actions to prevent reoccurrence or escalation
In this section provide only immediate remedial actions (corrective) and actions TO PREVENT REOCCURRENCE. Do not include medical response into this section	
Remedial Actions: *Provide long term remedial actions (if identified at the stage of reporting). For the incidents requiring further investigation do not include remedial actions. Those will have to be reported as a part of a final investigation report*	

Name: **Title:** **Date:**

Signature:

CSA International, Inc.

INCIDENT NOTIFICATION FORM

E-mail/Fax within 24 hrs to – Lynwood Powell, CSA Stuart Office – lpowell@conshelf.com

Originators Reference No:		**Project/Asset Group:**
Date of Incident:	**Time:**	**Exact Location**:
Client/Employing Company:		
Type of Incident:		
Initial Potential Consequence:		
Description of Incident: Where, when, what, how, who, and the operation in progress at the time (only factual).		
Immediate Action: Immediate remedial action and actions to prevent reoccurrence or escalation.		
Remedial Actions:		

Name: **Title:** **Date:**

Signature:

CSA International, Inc.

NEXT-OF-KIN INFORMATION

[redacted]

CSA INTERNATIONAL, INC.
DAILY SURVEY REPORT

Client: NOAA
Project: Water Column Profiling Survey
Location: GOM; MC Block 252
Job Number: CSA-2290
Date:

Vessel:
Client Rep:
Current location:
Satellite Phone #:
Onboard Email:

Weather Report
Wind speed/dir:
Wave height:
General:

PERSONNEL ON BOARD

CSA	*Client*	*Vessel*

CSA INTERNATIONAL, INC.
Daily Survey Report (*Cont'd*)

SAMPLE SUMMARY

Total Stations:		Total Stations:	
# Complete:	0	# Complete:	0
% Complete:	0.00%	% Complete:	0.00%

DAILY ACTIVITIES LOG

Time	*Description*

SUMMARY OF PROJECT TIME

Operation	*today*	*previous total*	*Total*
Mob/Demob			0
Operations			0
Standby Weather			0
Standby Other			0
Standby in Port			0
Standby Client			0
Technical Downtime			0
Vessel Downtime			0
Maintenance Time			0
TOTAL	0	0	**0**

CSA INTERNATIONAL, INC.
Daily Survey Report (*Cont'd*)

PLANNED ACTIVITY FOR NEXT 24 HOURS

ACCIDENTS/INCIDENTS

HAZARDS REPORTS

AUDITS COMPLETED

SIGHTINGS OF/INTERACTIONS WITH FISHERMEN

EMERGENCY DRILLS COMPLETED

HSE ISSUES/CONCERNS

MARINE MAMMAL/SEA TURTLE SIGHTINGS

CURRENT ESTIMATE OF COMPLETION DATE

CSA INTERNATIONAL, INC.
Daily Survey Report (*Cont'd*)

MONTHLY EVENTS

Event	*Quantity*
Number of Fatalities	
Number of Lost Time Injuries	
Number of Restricted Work Injuries	
Number of Medial Treatment Injuries	
Number of First Aid Injuries	
Number of Fires and Explosions	
Number Incidents involving Equipment Damage	
Number of Near Misses	
Number of Spills (to sea or land)	
Number of Security Incidents	
Number of hazard reports /STOP cards or safety observations	
Number of incidents involving stakeholder complaints	
Amount of waste generated, categorized by type. (monthly only)	
Amount of fuel oil / diesel used	

At the completion of the survey a report on injury absences and details of ongoing HSE Programs/Initiatives will be completed.

CSA INTERNATIONAL, INC.

Management of Change Order

Date:

To:

Subject:

Comments:

Project Change	Reason for Change

Approved by:

CSA Project Manager

_____

Client Representative

_____

Transfer of Personnel and Material at Sea

Purpose

This protocol applies to vessel operations involving the joint research being conducted aboard the Entrix/CSA research vessels in conjunction with the MC -252 Deepwater Horizon Spill Response efforts.

The type of water sampling being conducted on this mission requires lab analysis ashore of samples within 7 days from the time they are taken. Sample degradation occurs rapidly, necessitating supply vessels to recover these samples within 72 to 96 hours of collection from the sampling vessels or at other regular intervals on extended missions. Other supplies including food, equipment or spare parts may be transferred also. In addition to samples and supplies, personnel issues may require transfer of personnel from one vessel to another. These circumstances may arise from a medical emergency or other significant personal issue. This protocol is to provide safety guidance when conducting these operations at sea. This protocol is designed to apply to operations where the following conditions are true:

1. A vessel or vessels need supplies, equipment or spare parts,
2. A vessel or vessels need to discharge samples
3. Items to be transferred consist of scientific supplies to support the mission.
4. Personnel emergencies

For the purposes of this mission, all materials to be transferred are items that can be carried by 1 or 2 people. The bulk of these supplies include scientific equipment, water samples and personal effects. These rules do not apply to visitors to the ship including press, family members and USCG boarding personnel.

Application

It is the ultimate responsibility of the Master of each vessel involved to ensure the safety of all personnel involved in the operation. The Master of either vessel shall call off the operations if he or she believes it to be unsafe for any reason. Nothing in this protocol relieves the Master of this responsibility. The Master's judgment shall take into account (but is not limited to) the following factors:

1. Sea conditions
2. Weather conditions
3. Vessels involved
4. Crew fatigue
5. Crew experience
6. Equipment
7. Type and quantity of material to be transferred

This operation, except in the event of an emergency, shall not be conducted in the following conditions:

1. Night,

2. Restricted visibility,
3. Where traffic proximity is cause for concern and may involve a risk of collision,
4. Over a World Meteorological Organization (WMO) sea state of 3,
5. Where transferring goods at the dock is possible and practical,
6. Communications between the 2 vessels has not been established,
7. Where the Master of either vessel has any doubt.

Procedure

All at sea transfers shall be conducted only in daylight and at the discretion of the Master.

The method of approach shall be agreed upon by the Masters of both vessels. It is the choice of the Master to select the approach that is safest with regard to vessel type, configuration, fendering, deck height, vessel maneuverability as well as any other factors which may affect the operation. The operation described herein is common practice for such operations and shall be regarded as the default plan for all such operations.

Communication via VHF radio will be established and maintained throughout the entire operation.

The wheelhouses of both vessels shall be manned during the entire operation.

One individual aboard the Vessel other than the person(s) manning the wheelhouse shall supervise the operation on site and be in communication with the Vessel wheelhouse.

One individual on the Vessel shall be designated to stand by the transfer site with a life ring at the ready in the event of a man overboard. This individual will also be equipped with a radio.

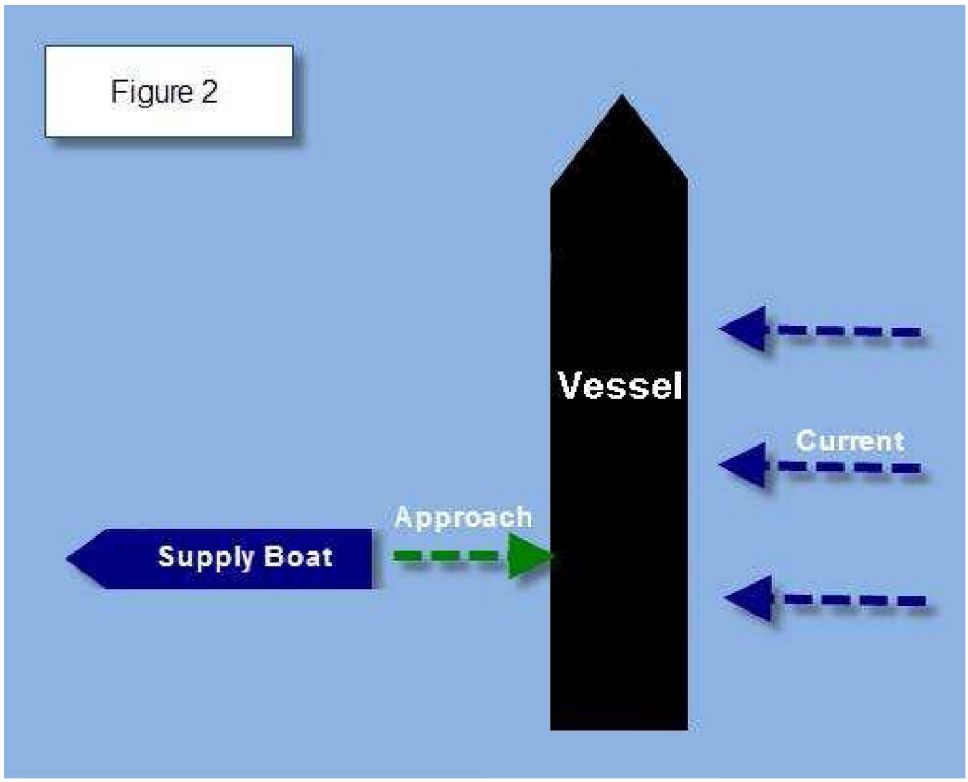
The Vessel shall, where practicable, be positioned in such a manner as to provide a lee and shelter the pilot boat from wind and waves.

The Vessel shall load from her aft deck either port or starboard side where the break in the gunwale provides the best access to the waterline with the least freeboard to the deck as shown in Figure A.

The vessel shall make no way as the supply vessel approaches.

The supply vessel will make contact with her centerline perpendicular to the hull of the Vessel (see fig. 2).

The supply vessel, where properly fendered, shall approach the Vessel down current and stern to (see fig 2).



Contact between the vessels shall be made while coasting at a safe and minimal speed. Forward propulsion by the supply boat may be used to slow the approach. If during the approach the docking angle is lost, the vessels shall reposition where safe and appropriate for another attempt.

No lines or entanglements shall make fast one vessel to the other.

If the vertical distance between the 2 decks used in the operation on either vessel is greater than 12 inches, then a pilot ladder or other approved boarding equipment shall be used.

Material shall be transferred in a slow and deliberate manner.

If a crane is available, all materials shall be handed across using the crane to move materials from one vessel to another.

Other than in an emergency, vessels will break contact only under the following conditions:

1. The supervisor has ensured all personnel are in a safe position to break contact,
2. The pilot ladder has been recovered,
3. The Masters of both vessels involved agree to end the operation,
4. It is safe to do so.

PPE

All personnel on deck must wear an approved buoyant work vest.

All personnel involved in the operation on deck shall wear an approved hard hat, safety glasses, long pants and closed toe shoes/steel toe shoes where company safety regulations apply.

Requisition

At sea transfer missions shall be requested prior to the Vessel's departure from the port and incorporated into the vessel's mission planning.

Emergency

Nothing in this protocol shall prevent the master of either vessel from taking action in an emergency. This protocol governs only routine scientific supply transfers. The ability of the master to transfer personnel, stores or equipment in a safety or medical emergency shall not be infringed.

SIMOPS and Offshore Reporting Procedures for the MC252 NRDA Scientific Fleet
Updated 4/7/11

All NRDA Scientific Vessels must adhere to these guidelines for simultaneous operations (SIMOPS) when conducting operations in conjunction with the MC-252 Deepwater Horizon Incident. Vessels must supply information regarding cruise operations 48 hours prior to departure as well as daily during cruises. SIMOPS procedures may be modified at any time, resulting in changes that would be communicated to NRDA vessels while at sea.

SIMOPS Procedures

1. Provide information on cruise and equipment 48 hours prior to departure.

Inform the following individuals via e-mail of your anticipated departure time, closest point of approach to the MC-252 wellhead, nature of activities, general equipment to be used, and the make, model, and frequency of any acoustic devices to be employed. E-mail subject line should be "[Vessel Name]: Pre-departure Contact" and should be sent to:

chad.smith@darkwatermarine.com	Joint NRDA Vessel Operations Coordinator (NOAA Rep)
jodi.harney@cardno.com	Vessel Committee (Cardno ENTRIX Representative)
dwhnrdafieldops@gmail.com	NOAA/Trustee Distribution List Manager

2. Submit Daily Situation Reports ("SITREPs").

Prior to departure, begin submitting a Vessel Situation Report (form provided in PDF format) by 0800 daily. E-mail subject line should be "[Vessel Name]: Daily Vessel SITREP [Date]" and should be sent to:

chad.smith@darkwatermarine.com	Joint NRDA Vessel Operations Coordinator (NOAA Rep)
jodi.harney@cardno.com	Vessel Committee (Cardno ENTRIX Representative)
dwhnrdafieldops@gmail.com	NOAA/Trustee Distribution List Manager
geir.karlsen@bp.com	BP SIMOPS lead, Houston
craig.scherschel@bp.com	BP Science & Technology, Houston
jeffrey.dingler@bp.com	BP AUV MC-252 Well Abandonment Survey Manager
rdaileytx@gmail.com	Captain of the vessel *Miss Ginger*, AUV operations

Safety Information

1. Acoustics

When using acoustic devices, frequencies must be coordinated with SIMOPS 48 hours prior to departure to avoid interference. Acoustic devices include echo sounders and USBL, ADCP, and multibeam systems. The vessel must be prepared to discontinue acoustic transmission immediately if SIMOPS or any vessel in the field reports any interference. VHF and SAT phone must be monitored closely for such contact. Rapid response and monitoring of communications in this situation is an absolute safety imperative.

2. Vessel-to-Vessel Communications

At present, there is no required call-in for vessel operating in the field. Vessels should provide the *Miss Ginger* a three-mile berth at all times and should communicate directly via VHF or SAT phone when working near the vessel. If approach is unavoidable, VHF communications must me established with the vessel in question and a passing arrangement agreed to in accordance with the International Rules of

the Road. The *Miss Ginger* can be reached at the following sat phone numbers and monitor 16, 18, and 64.

Bridge: 337-769-9032 (Captain)
Lab: 337-769-9033 (Richard Daily)

3. MC-252 Wellhead Access and Hazard Avoidance

There is a court-ordered exclusion zone around the wreckage of the Deepwater Horizon located near the MC-252 wellhead (position 28° 44.483' N, 88° 22.050' W). No vessels are permitted within 750' of this location. Other mapped and unmapped hazards may exist in the water column and on the seafloor in the area. Navigators from Continental Shelf Associates (CSA) on board NRDA fleet vessels will be supplied with the location and nature of known, mapped hazards.

Definitions

1. SIMOPS

Simultaneous Operations exists as to provide coordination and information exchange with the mission to facilitate safe and coordinated operations at and around the Deepwater Horizon incident site in Mississippi Canyon Block 252. Strict protocols were employed during the Response and initial NRDA phases. Reduced vessel traffic reduced the need for daily check-in calls, but compliance with SIMOPS procedures is still an expectation of all vessels in the area.

2. NRDA Vessel Coordination Committee

A group which coordinates the needs of offshore vessels, proposed cruise plans, and vessel operations. The committee includes representatives from BP, Trustees, CSA, and Cardno ENTRIX. A conference call is held every Monday at 1530 CDT.

3. NRDA Field Ops

Trustee NRDA Field Ops facilitates the placement of crews on NRDA vessels and assists with general logistics.

Contacts

Name	Role, Affiliation	Email	Phone
Cragan, Jenna	Project Scientist, ASA/NOAA	jcragan@asascience.com	(401) 316-5600
Graham, Eileen	Project Scientist, ASA/NOAA	egraham@asascience.com	(443) 745-5323
Harney, Jodi	Project Scientist, Cardno ENTRIX	jodi.harney@cardno.com	(813) 373-8479
Karlsen, Geir	SIMOPS Lead, BP Houston	geir.karlsen@bp.com	(281) 366-4315
Mulcahy, Bob	Operations Lead, Continental Shelf Associates	rmulcahy@conshelf.com	(561) 758-7152
NOAA NRDA Field Ops	Trustee Logistics	dwhnrdafieldops@gmail.com	(504) 410-7787
Smith, Chad	Joint NRDA Vessel Operations Coordinator, NOAA Rep	chad.smith@darkwatermarine.com	(617) 999-4163

DWH Vessel Daily SitRep

Vessel Name: | In Port ○ | Underway ◉ | Date:

Next Port of Call: | ETA/ETD:

Current Position: | Time (24 hr):

Latitude: | Longitude:

Cruise Plan Title:

Current Operations:

Operating within 15 NM/28 km of Wellhead? YES ◉ NO ○

If yes, list acoustic instrumentation onboard and frequencies used.

Operational Issues:

Additional Comments:

Submitted by:

Email daily by 0800 to:
chad.smith@darkwatermarine.com (Vessel Ops)
dwhnrdafieldops@gmail.com (Trustee Rep)
jodi.harney@cardno.com (BP Rep)

ANALYTICAL QUALITY ASSURANCE PLAN

MISSISSIPPI CANYON 252 (DEEPWATER HORIZON) NATURAL RESOURCE DAMAGE ASSESSMENT

Version 2.2

Prepared for:

U.S. Department of Commerce
National Oceanic and Atmospheric Administration

January 20, 2011

TABLE OF CONTENTS

VERSION 2.2 CHANGES FROM VERSION 2.1:

<table>
<tr><th>Page</th><th>Change</th></tr>
<tr><td>Cover</td><td>Updated version # & date</td></tr>
<tr><td>Acronyms</td><td>Inserted DOSS</td></tr>
<tr><td>4</td><td>Inserted discussion re: Corexit Indicator Compound analysis (see below)
Corexit indicator compounds can be identified and (semi-) quantified by conventional GC/MS-SIM. The indicator compounds presently identified include: 2-butoxyethanol, three closely-eluting glycol ether isomers (reported together as a single analyte), and bis-(2-ethylhexyl)fumarate (the latter of which is a thermal degradation product of DOSS formed in the GC injection port). These indicator compounds can be identified in samples prepared for alkylated PAH analysis using conventional solvent extraction and preparation. These indicator compounds can be analyzed for concurrently with the alkylated PAHs during the same GC/MS acquisition by adding appropriate ions to the file. Suggested ions for monitoring are listed in Table 1.1.g. Indicator compound identifications are confirmed by analyzing a Corexit standard (i.e., a mixture of Corexit 9500 and 9527) under the same conditions as used for samples by comparing ion patterns and GC retention times. Semi-quantitative results for these indicator compounds can be based on a normalized response factor of 1 (without surrogate correction), and then the concentrations reported flagged by the laboratory as semi-quantitative.</td></tr>
<tr><td>4</td><td>Corrected table reference – Table 1.1g to Table 6.1g</td></tr>
<tr><td>5</td><td>In table removed X from SHC/TEH for Tissue</td></tr>
<tr><td>7</td><td>Removed Water (TEH) from Target MDL</td></tr>
<tr><td>7</td><td>Added Target Reporting Limit for Water (TEH/TEM) at 200 ug/L</td></tr>
<tr><td>10</td><td>Added T22a-Gammacerane/C32-diahopane to Table 1.1e –Petroleum Biomarkers</td></tr>
<tr><td>11</td><td>Added Corexit Indicator Compounds table (Table 1.1g)
TABLE 1.1g
Corexit Indicator Compounds for Qualitative Analysis in Water Only (monitoring mass/charge ion)
<table><tr><td>2-Butoxyethanol (m/z 87, 75)</td></tr><tr><td>Glycol ether Isomers (m/z 59, 103)</td></tr><tr><td>Bis-(2-ethylhexyl) fumarate (m/z 112, 211)</td></tr></table></td></tr>
<tr><td>13</td><td>Corrected Greg Salata email address to gsalata@caslab.com</td></tr>
<tr><td>14</td><td>Added two rows to preservation and holding time table – Sediment for VOC, and Water for DOSS<table><tr><td>Section 3.1</td><td></td><td></td><td></td></tr><tr><td>Sediment for VOC</td><td>Refrigeration 4°+ 2C</td><td>14 days</td><td>Not Applicable</td></tr><tr><td>Water for DOSS</td><td>Frozen, 15mL plastic centrifuge tubes so entire container can be solvent rinsed</td><td>Not established</td><td>Not established</td></tr></table></td></tr>
<tr><td>14</td><td>Table under Section 3.1: Changed header “Holding Time for Extracts” to read “Holding Time to Analysis”</td></tr>
<tr><td>14</td><td>For VOC stated Not Applicable in “Holding Time to Extraction” and moved holding times to last column (Holding Time to Analysis)</td></tr>
<tr><td>14</td><td>In last column – changed the footnote numbers from “9” to “12”</td></tr>
</table>

<table>
<tr><th>Page</th><th>Change</th></tr>
<tr><td>14</td><td>Replaced the rows for Sediment and Tissue matrices with the rows below.
<table>
<tr><th>Matrix</th><th>Storage for Samples</th><th>Holding Time to Extraction</th><th>Holding Time to Analysis</th></tr>
<tr><td>Sediment/Soil for PAH, SHC/TEH, Biomarkers, total solids, grain size and TOC</td><td>Frozen; except Grain Size should not be frozen - store at 4°C ±2°</td><td>1 Year; except not applicable for grain size, total solids and TOC.</td><td>40 days from extraction[12]; except biomarkers grain size and TOC no holding time.</td></tr>
<tr><td>Tissue for PAH, SHC/TEH, Biomarkers, and Total Extractable Organics (TEO, aka Lipids)</td><td>Frozen</td><td>1 Year</td><td>40 days from extraction[12]; except biomarkers and TEO no holding time.</td></tr>
</table></td></tr>
<tr><td>20</td><td>First line: changed 10X to 5X, removed "(whichever is lower)"</td></tr>
<tr><td>21</td><td>Changed Mass Discrimination MQO to read Ratio for the “concentration” (rather than raw area)</td></tr>
<tr><td>24, 25</td><td>Removed "Draft" from table titles</td></tr>
<tr><td>26</td><td>Table 6.1f: Changed “Grain Size” method description to the following:
Grain Size (apparent): ASTM D422. If using sieve analysis only, report as percent gravel, coarse sand, medium sand, fine sand, very fine sand, and silt/clay. If using sieve and hydrometer, report as percent gravel, coarse sand, medium sand, fine sand, very fine sand, silt, and clay.</td></tr>
<tr><td>26</td><td>Added web address for Plumb method reference;
http://yosemite.epa.gov/r10/CLEANUP.NSF/ph/T4%20Technical%20Documents/$FILE/Plumb.pdf</td></tr>
</table>

Acronyms and Abbreviations

%D	Percent difference
%R	Percent recovery
ASTM	American Society for Testing and Materials
BS/BSD	Blank spike/blank spike duplicate
CCV	Continuing calibration verification
CRM	Certified reference material
DISP	Dispersant
DOSS	Dioctylsulfosuccinate salt
DOT	U.S. Department of Transportation
DQO	Data quality objectives
EDD	Electronic data deliverable
EIP	Extracted ion Profile
EPA	U.S. Environmental Protection Agency
GC/MS-SIM	Gas chromatography with low resolution mass spectrometry using selected ion monitoring
GC-FID	Gas chromatography with flame ionization detection
LC	Liquid chromatography
MC 252	Mississippi Canyon 252 (Deepwater Horizon)
MDL	Method detection limit
MQO	Measurement quality objectives
MS/MSD	Matrix spike/matrix spike duplicate
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural resource damage assessment
OPA	Oil Pollution Act
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbons
PIANO	Paraffins, isoparafins, aromatics, napthenes, olefins
QA	Quality assurance
QAP	Quality assurance plan
QC	Quality control
RM	Reference material
RPD	Relative percent difference
RSD	Relative standard deviation
SHC	Saturated hydrocarbons
SOP	Standard Operating Procedures
TEH	Total extractable hydrocarbons
TEM	Total extractable matter
TEO	Total extractable organics
TOC	Total organic carbon
USEPA	U.S. Environmental Protection Agency
VOC	Volatile organic compounds

INTRODUCTION

On April 20, 2010, a fatal explosion struck the Deepwater Horizon offshore oil platform approximately 50 miles off the Louisiana coast in the Gulf of Mexico, ultimately leading to the destruction of the platform and the connecting riser pipe to the seafloor a mile below the water surface, and the ongoing release of thousands of barrels of crude oil from the seafloor per day. The incident has been declared a Spill of National Significance by the U.S. Secretary of Homeland Security and a major spill response effort is in progress. The spill threatens a broad expanse of the U.S. Gulf Coast in addition to the natural resources in the path of the oil slick which has spread across thousands of square miles at sea. Federal and state natural resource trustees have begun collecting ephemeral data to support a natural resource damage assessment (NRDA). Currently, NOAA is the lead administrative trustee. Although a formal agreement has not yet been reached, BP America has indicated an interest in cooperating with the natural resource trustees in the damage assessment.

This Analytical Quality Assurance (QA) Plan describes the minimum requirements for the chemical analysis of the environmental samples that are collected in support of this NRDA. This plan does not address the actual field collection or generation of these samples. The scope of the laboratory work is twofold: (1) generate concentrations for key chemicals used in injury determinations for crude oil releases, and (2) produce more extensive chemical data to use in fingerprinting for source identification. The applicable chemicals, need and frequency of environmental sample analyses, quality control requirements, and data usage vary for these two purposes, although implementation of this plan enables both to be achieved. In recognition of these differences, sampling plans may reference the Analytical QA Plan and cite to specific tables of chemical analyses that are appropriate to the needs of the particular sampling effort.

The requirements specified in this plan are designed to: (1) monitor the performance of the measurement systems to maintain statistical control over the reported concentrations of target analytes and provide rapid feedback so that corrective measures can be taken before data quality is compromised and; (2) verify that reported data are sufficiently complete, comparable, representative, unbiased and precise so as to be suitable for their intended use.

The analytes of concern addressed in this QA Plan are polycyclic aromatic hydrocarbons (PAHs) including alkyl homologues, saturated hydrocarbons (SHC), total extractable hydrocarbons (TEH)[1], and volatile organic compounds (VOCs) and petroleum biomarkers. Additional analytes of concern are potentially toxic polar and non-polar components found within or formed from the dispersant agents utilized during the response to the incident, although the appropriate target analytes and methods are not yet established. A variety of matrices may be analyzed including water, filters, sediment/soil, tissues, vegetation, absorbent materials (e.g. Teflon nets, etc.), oils and oil debris. In addition to the primary analytes of concern, ancillary tests may include: percent moisture, total organic carbon (TOC) and grain size for sediment samples, and total extractable organics (TEO) for tissues. Additional tests not

[1] TEH is the total aromatic and aliphatic content as determined by GC-FID. If the sample extract is not "cleaned up" to remove biogenic material prior to the GC-FID analysis, then the result from the GC-FID analysis is termed Total Extractable Matter (TEM).

currently addressed in the QAP but may be of interest are: SARA (%Saturate, %Aromatic, %Resin, %Asphaltene) content in oil[2]; carbon, hydrogen, and nitrogen (CHN)[3] for sediments and particulate material in water. Performance criteria will be added to the QAP for additional tests when requested under the NRDA program.

The work plans and associated QA plans under which these samples were generated or collected are independent documents and not included or considered herein. This Analytical QA Plan describes the minimum requirements to be taken to provide for the chemical analyses (and associated physical normalizing parameters) of the previously generated or collected samples in a technically sound and legally defensible manner.

This Analytical QA Plan is consistent with the intent of NRDA regulations under OPA (33 U.S.C. §§ 2701 *et seq.)* and satisfies the requirements listed in the relevant EPA guidance for QA plans (USEPA 2002 and USEPA 2001) as far as the documents relate to analytical testing services. This QA plan will be revised as appropriate, as changes are made to the NRDA and the QA program.

---

[2] SARA according to method published by Zumberge et al (2005) or equivalent. [Zumberge, J., J.A. Russell, and S.A. Reid . 2005. Charging of Elk Hills reservoirs as determined by oil geochemistry AAPG Bull. v. 89, pp. 1347-1371]

[3] CHN by micro elemental analyzer using the Dumas method of complete and instantaneous oxidation (flash dynamic combustion) at >1,000 °C following exposure of the sample to HCl fumes to remove inorganic carbon.

1.0 PROJECT DESCRIPTION

A number of laboratories will be analyzing samples associated with this NRDA. The intent of this plan is to present the minimum requirements for the performance criteria for the laboratories providing data in support of this investigation. The analytes of specific interest and brief descriptions of the analytical methods are as follows:

- PAHs including alkyl homologues by gas chromatography with low resolution mass spectrometry using selected ion monitoring (GC/MS-SIM). The analytical procedure is based on EPA Method 8270D with the GC and MS operating conditions optimized for separation and sensitivity of the target analytes. Alkyl PAH homologues are quantified using a response factor assigned from the parent PAH compound. Analytes, associated response factors and target detection limits are listed in **Table 1.1a.** The following references discuss the method options in further detail:

  Federal Register 40CFR300, Subchapter J, Part 300, Appendix C, 4-6-3 to 4-6-5 pp. 234-237.

  Murphy, Brian L. and Robert D. Morrison (Editors). 2007. *Introduction to Environmental Forensics*, 2nd Edition. Chapter 9, p. 389 – 402;

  Page, D.S., P.D. Boehm, G.S. Douglas, and A.E. Bence. 1995. Identification of hydrocarbon sources in the benthic sediments of Prince William Sound and the Gulf of Alaska following the *Exxon Valdez* oil spill. *In*: *Exxon Valdez Oil Spill: Fate and Effects in Alaskan Waters, ASTM STP 1219*, P.G. Wells, J.N. Bulter, and J.S. Hughes, Eds, American Society for Testing and Materials, Philadelphia. pp 44-83.

  Kimbrough, K.L., G.G. Lauenstein and W.E. Johnson (Editors). 2006. *Organic Contaminant Analytical methods of the National Status and Trends Program: Update 2000-2006*. NOAA Technical Memorandum NOS NCCOS 30. p. 25- 37.

  Sauer, T.C. and P.D. Boehm. 1995. *Hydrocarbon Chemistry Analytical Methods for Oil Spill Assessments*. MSRC Technical Report Series 95-032, Marine Spill Response Corporation, Washington, D.C. 114 p.

  USEPA. 2008. *Test Methods for Evaluating Solid Waste, Physical/Chemical Method* (SW846).

  Wang, Z. and S.A. Stout. 2007. Chemical fingerprinting of spilled or discharged petroleum – methods and factors affecting petroleum fingerprints in the environment. In: *Oil Spill Environmental Forensics: Fingerprinting and Source Identification*. Z. Wang and S.A. Stout, Eds, Elsevier Publishing Co., Boston, MA, pp. 1-53.

- Saturate hydrocarbons by gas chromatography with flame ionization detection (GC/FID) based on EPA Method 8015. Analytes and target detection limits are listed in **Table 1.1b**.

- Total Extractable Hydrocarbons (TEH[4]) representing the total aromatic and aliphatic hydrocarbon content of sample extracts after silica gel clean-up and analysis by GC/FID (**Table 1.1b**). The result is reported based on integration of the FID signal over the entire hydrocarbon range from *n*-C9 to n-C44 and calibrated against the average alkane hydrocarbon response factor.

  If the sample extract does not receive any clean-up then the result will be reported as Total Extractable Matter (TEM) because the extract may contain non-hydrocarbon compounds. . Either TEH or TEM may reported by the laboratory depending on the handling of the extract.

- Standard volatile organic compounds (VOC) by GC/MS based on EPA Method 8260B but for aromatics hydrocarbons only. Analytes and target detection limits are listed in **Table 1.1c.**

- Extended list of VOCs for a specialized fingerprinting analysis of paraffins, isoparaffins, aromatics, napthenes, and olefins (PIANO) by GC/MS. Analytes and target detection limits are provided in **Table 1.1d** for this source identification list.

- Petroleum biomarkers by GC/MS-SIM. Two methods for the analysis of petroleum biomarkers are contained herein, viz., quantitative and qualitative. The difference between these two analyses is that quantitative analysis produces absolute concentrations of target analytes whereas qualitative analysis produced pattern, or fingerprints, only. The proposed target analyte list for quantitative biomarkers is provided in **Table 1.1e.** This list may be expanded if warranted. This method is discussed in further detail in:

  Murphy, Brian L. and Robert D. Morrison (Editors). 2007. *Introduction to Environmental Forensics*, 2nd Edition. Chapter 9, p. 389 – 402;

  Wang, Z.. Stout, S.A., and Fingas, M. (2006) Forensic fingerprinting of biomarkers for oil spill characterization and source identification (Review). *Environ. Forensics* **7(2)**: 105-146.

- Qualitative biomarker patterns may also be acquired using GC/MS-SIM with monitoring of selected ions (m/z) as provided in **Table 1.1f**. Since no concentration data are generated by qualitative analysis the results are reported as hardcopy PDF files of each ion over the appropriate retention time(s) and scale and included in the hardcopy data package produced by the laboratory.

- Corexit indicator compounds can be identified and (semi-) quantified by conventional GC/MS-SIM. The indicator compounds presently identified include: 2-butoxyethanol, three closely-eluting glycol ether isomers (reported together as a single analyte), and

---

[4] Note that the term TEH is being used for the total hydrocarbon analysis. The term "Total Petroleum Hydrocarbon" (TPH) may be used to refer to TEH, in some instances. For this QAP, the term TEH is used to avoid confusion with state-regulated gasoline or diesel determinations, rather TEH is used to refer to the sum of hydrocarbons from C_9 to C_{44}.

bis-(2-ethylhexyl)fumarate (the latter of which is a thermal degradation product of DOSS formed in the GC injection port). These indicator compounds can be identified in samples prepared for alkylated PAH analysis using conventional solvent extraction and preparation. These indicator compounds can be analyzed for concurrently with the alkylated PAHs during the same GC/MS acquisition by adding appropriate ions to the file. Suggested ions for monitoring are listed in **Table 1.1.g**. Indicator compound identifications are confirmed by analyzing a Corexit standard (i.e., a mixture of Corexit 9500 and 9527) under the same conditions as used for samples by comparing ion patterns and GC retention times. Semi-quantitative results for these indicator compounds can be based on a normalized response factor of 1 (without surrogate correction), and then the concentrations reported flagged by the laboratory as semi-quantitative.

- Corexit 9500/9527 dispersant (DISP) by liquid chromatography (LC)/MS for quantitative assessment, particularly dioctylsulfosuccinate sodium salt (DOSS). Proposed measurement performance criteria are presented in **Table 6.1g**. Because the method is under development the laboratory may develop appropriate performance criteria based on past method performance.

- GC/MS may have use for qualitative assessments of solvent package components (e.g. glycol ethers) or primary degradation products of DOSS (alkyl diesters), pending further method development. Standard methods are not available for either technique but provisional analytical criteria and detection limits are under development.

Analyses will include a number of different sample matrices. Matrices that will be analyzed will be determined in sampling plans and may not include all analyses for each matrix. The following table provides a summary of which analyses may be applicable to each matrix (analyses may be added or deleted as warranted over time).

Matrix	PAH	SHC/TEH	BIOMARK	DISP	VOC
Water	X	X	X	X	X
Filters	X	X	X		
Sediment/Soil	X	X	X	X	X
Tissue	X		X	X	
Vegetation	X	X	X	X	
Inert Sorbent Materials	X	X	X	X	X
Oil/Oily Debris	X	X	X	X	X

TABLE 1.1a
Extended PAH (Parent and Alkyl Homologs) and Related Compounds

	Compound	RF Source[5]
D0	cis/trans-Decalin	
D1	C1-Decalins	D0 or tD0[6]
D2	C2-Decalins	D0 or tD0
D3	C3-Decalins	D0 or tD0
D4	C4-Decalins	D0 or tD0
BT0	Benzothiophene	
BT1	C1-Benzo(b)thiophenes	BT0
BT2	C2-Benzo(b)thiophenes	BT0
BT3	C3-Benzo(b)thiophenes	BT0
BT4	C4-Benzo(b)thiophenes	BT0
N0	Naphthalene	
N1	C1-Naphthalenes	N0
N2	C2-Naphthalenes	N0
N3	C3-Naphthalenes	N0
N4	C4-Naphthalenes	N0
B	Biphenyl	
DF	Dibenzofuran	
AY	Acenaphthylene	
AE	Acenaphthene	
F0	Fluorene	
F1	C1-Fluorenes	F0
F2	C2-Fluorenes	F0
F3	C3-Fluorenes	F0
A0	Anthracene	
P0	Phenanthrene	
PA1	C1-Phenanthrenes/Anthracenes	P0
PA2	C2-Phenanthrenes/Anthracenes	P0
PA3	C3-Phenanthrenes/Anthracenes	P0

	Compound	RF Source
PA4	C4-Phenanthrenes/Anthracenes	P0
RET	Retene	RET or P0
DBT0	Dibenzothiophene	
DBT1	C1-Dibenzothiophenes	DBT0
DBT2	C2-Dibenzothiophenes	DBT0
DBT3	C3-Dibenzothiophenes	DBT0
DBT4	C4-Dibenzothiophenes	DBT0
BF	Benzo(b)fluorene	BF or FL0
FL0	Fluoranthene	
PY0	Pyrene	
FP1	C1-Fluoranthenes/Pyrenes	FL0 or PY0
FP2	C2-Fluoranthenes/Pyrenes	FL0 or PY0
FP3	C3-Fluoranthenes/Pyrenes	FL0 or PY0
FP4	C4-Fluoranthenes/Pyrenes	FL0 or PY0
NBT0	Naphthobenzothiophenes	
NBT1	C1-Naphthobenzothiophenes	NBT0
NBT2	C2-Naphthobenzothiophenes	NBT0
NBT3	C3-Naphthobenzothiophenes	NBT0
NBT4	C4-Naphthobenzothiophenes	NBT0
BA0	Benz[a]anthracene	
C0	Chrysene/Triphenylene	
BC1	C1-Chrysenes	C0
BC2	C2-Chrysenes	C0
BC3	C3-Chrysenes	C0
BC4	C4-Chrysenes	C0
BBF	Benzo[b]fluoranthene	
BJKF	Benzo[j,k]fluoranthene	BKF[8]
BAF	Benzo[a]fluoranthene	BKF or BAF

	Compound	RF Source
BEP	Benzo[e]pyrene	
BAP	Benzo[a]pyrene	
PER	Perylene	
IND	Indeno[1,2,3-cd]pyrene	
DA	Dibenz[a,h]anthracene	
GHI	Benzo[g,h,i]perylene	
4MDT	4-Methyldibenzothiophene	DBT0
2MDT	2/3-Methyldibenzothiophene	DBT0
1MDT	1-Methyldibenzothiophene	DBT0
3MP	3-Methylphenanthrene	P0
2MP	2/4-Methylphenanthrene	P0
2MA	2-Methylanthracene	P0
9MP	9-Methylphenanthrene	P0
1MP	1-Methylphenanthrene	P0
	2-Methylnaphthalene	
	1-Methylnaphthalene	
	2,6-Dimethylnaphthalene	
	1,6,7-Trimethylnaphthalene	
	Other	
	Carbazole	
	C30-Hopane[7]	

Target Method Detection Limit Range

Sediment/Soil = 0.1 – 0.5 ng/g dry weight
Tissue = 0.2 – 1.0 ng/g wet weight
Water = 1 – 5 ng/L

Target Reporting Limit

Oil = 2.0 mg/kg

[5] Response factor (RF) to be used for quantitation. If blank, compound is included in the calibration mix

[6] tD0 = transD0 (used if cis/trans in separate standards)

[7] Quantitative concentrations of C29-hopane and 18α-oleanane may be provided if laboratories are calibrated to do so; the C30-hopane is a minimum requirement.

[8] BKF = Benzo(k)fluoranthene. Benzo(j)fluoranthene and Benzo(k)fluoranthene coelute and will be reported as Benzo(j,k)fluoranthene (BJKF)

TABLE 1.1b
Saturated Hydrocarbons (Alkanes/Isoprenoids Compounds) and Total Extractable Hydrocarbons

Abbr.	Analyte
nC9	n-Nonane
nC10	n-Decane
nC11	n-Undecane
nC12	n-Dodecane
nC13	n-Tridecane
1380	2,6,10 Trimethyldodecane
nC14	n-Tetradecane
1470	2,6,10 Trimethyltridecane
nC15	n-Pentadecane
nC16	n-Hexadecane
nPr	Norpristane
nC17	n-Heptadecane
Pr	Pristane
nC18	n-Octadecane
Ph	Phytane
nC19	n-Nonadecane
nC20	n-Eicosane
nC21	n-Heneicosane
nC22	n-Docosane

Abbr.	Analyte
nC23	n-Tricosane
nC24	n-Tetracosane
nC25	n-Pentacosane
nC26	n-Hexacosane
nC27	n-Heptacosane
nC28	n-Octacosane
nC29	n-Nonacosane
nC30	n-Triacontane
nC31	n-Hentriacontane
nC32	n-Dotriacontane
nC33	n-Tritriacontane
nC34	n-Tetratriacontane
nC35	n-Pentatriacontane
nC36	n-Hexatriacontane
nC37	n-Heptatriacontane
nC38	n-Octatriacontane
nC39	n-Nonatriacontane
nC40	n-Tetracontane

TEH	$\Sigma(C_9\text{-}C_{44})$ Integration of the FID signal over the entire hydrocarbon range from n-C9 to n-C44 after silica gel cleanup.
TEM	$\Sigma(C_9\text{-}C_{44})$ Integration of the FID signal over the entire hydrocarbon range from n-C9 to n-C44 no silica gel cleanup.

	Target Method Detection Limit
Sediment (Alkanes) =	0.01 µg/g dry weight
Sediment (TEH) =	1 µg/g dry weight
Water (Alkanes) =	0.8 µg/L
	Target Reporting Limit
Oil (Alkanes) =	200 mg/kg
Oil (TEH) =	200 mg/kg
Water (TEH/TEM) =	200 µg/L

TEH = Total Extractable Hydrocarbons with silica gel "clean-up"
TEM = Total Extractable Matter with no extract "clean-up"

TABLE 1.1c
Standard Volatile Organic Compounds

Analyte
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
4-Isopropyltoluene
Benzene
Ethylbenzene
Isopropylbenzene
m,p-Xylenes
Naphthalene[9]
n-Butylbenzene
n-Propylbenzene
o-Xylene
sec-Butylbenzene
Styrene
tert-Butylbenzene
Toluene

	Target Method Detection Limit Range
Sediment/Soil =	0.1 – 1 ng/g
Water =	0.05 – 0.5 µg/L
	Target Reporting Limit
Oil =	2 mg/kg

[9] Naphthalene is also included on the **Table 1.1a** target analyte list of PAH compounds. The PAH analysis is the preferred method, rather than this volatile method. Thus, if a sample location is analyzed for both PAH and VOC the result from the PAH analysis will be noted in the database as the preferred result.

TABLE 1.1d
C5-C13 Volatile Compounds for PIANO Forensic Assessment

Abbrev.	Analyte
IP	Isopentane
1P	1-Pentene
2M1B	2-Methyl-1-butene
C5	Pentane
T2P	2-Pentene (trans)
C2P	2-Pentene (cis)
TBA	Tertiary butanol
CYP	Cyclopentane
23DMB	2,3-Dimethylbutane
2MP	2-Methylpentane
MTBE	MTBE
3MP	3-Methylpentane
1HEX	1-Hexene
C6	Hexane
DIPE	Diisopropyl Ether (DIPE)
ETBE	Ethyl Tertiary Butyl Ether (ETBE)
22DMP	2,2-Dimethylpentane
MCYP	Methylcyclopentane
24DMP	2,4-Dimethylpentane
12DCA	1,2-Dichloroethane
CH	Cyclohexane
2MH	2-Methylhexane
B	Benzene
23DMP	2,3-Dimethylpentane
THIO	Thiophene
3MH	3-Methylhexane
TAME	TAME
1H	1-Heptene/1,2-DMCP (trans)
ISO	Isooctane
C7	Heptane

Abbrev.	Analyte
MCYH	Methylcyclohexane
25DMH	2,5-Dimethylhexane
24DMH	2,4-Dimethylhexane
223TMP	2,2,3-Trimethylpentane
234TMP	2,3,4-Trimethylpentane
233TMP	2,3,3-Trimethylpentane
23DMH	2,3-Dimethylhexane
3EH	3-Ethylhexane
2MHEP	2-Methylheptane
3MHEP	3-Methylheptane
T	Toluene
2MTHIO	2-Methylthiophene
3MTHIO	3-Methylthiophene
1O	1-Octene
C8	Octane
12DBE	1,2-Dibromoethane
EB	Ethylbenzene
2ETHIO	2-Ethylthiophene
MPX	p/m-Xylene
1N	1-Nonene
C9	Nonane[10]
STY	Styrene
OX	o-Xylene
IPB	Isopropylbenzene
PROPB	n-Propylbenzene
1M3EB	1-Methyl-3-ethylbenzene
1M4EB	1-Methyl-4-ethylbenzene
135TMB	1,3,5-Trimethylbenzene
1D	1-Decene
1M2EB	1-Methyl-3-isopropylbenzene

Abbrev.	Analyte
C10	Decane[10]
124TMB	1,2,4-Trimethylbenzene
SECBUT	sec-Butylbenzene
1M3IPB	1-Methyl-3-isopropylbenzene
1M4IPB	1-Methyl-4-isopropylbenzene
1M2IPB	1-Methyl-2-isopropylbenzene
IN	Indan
1M3PB	1-Methyl-3-propylbenzene
1M4PB	1-Methyl-4-propylbenzene
BUTB	n-Butylbenzene
12DM4EB	1,2-Dimethyl-4-ethylbenzene
12DEB	1,2-Diethylbenzene
1M2PB	1-Methyl-2-propylbenzene
14DM2EB	1,4-Dimethyl-2-ethylbenzene
C11	Undecane[10]
13DM4EB	1,3-Dimethyl-4-ethylbenzene
13DM5EB	1,3-Dimethyl-5-ethylbenzene
13DM2EB	1,3-Dimethyl-2-ethylbenzene
12DM3EB	1,2-Dimethyl-3-ethylbenzene
1245TMP	1,2,4,5-Tetramethylbenzene
PENTB	Pentylbenzene
C12	Dodecane[10]
N0	Naphthalene[11]
BT0	Benzothiophene[11]
MMT	MMT
C13	Tridecane[10]
2MN	2-Methylnaphthalene[11]
1MN	1-Methylnaphthalene[11]

Target Detection Limit

Sediment/Soil = 0.1 – 10 ng/g

Water = 0.2 - 2.0 µg/L

Target Reporting Limit

Oil = 2 mg/kg

[10] These compounds are also included on the **Table 1.1b** target analyte list of saturate hydrocarbons. Because of the extraction technique, the GC-FID method for hydrocarbons is the preferred method, rather than this volatile method. Thus, if a sample location is analyzed for both saturate hydrocarbons by GC-FID and VOC the result from the GC-FID analysis will be noted in the database as the preferred result.

[11] These compounds are also included on the **Table 1.1a** target analyte list of PAH compounds. Because of the extraction technique, the PAH analysis is the preferred method, rather than this volatile method. Thus, if a sample location is analyzed for both PAH and VOC the result from the PAH analysis will be noted in the database as the preferred result.

TABLE 1.1e
Petroleum Biomarkers for Quantitative Analysis

Compound *	Quant Ion m/z
C23 Tricyclic Terpane (T4)	191
C24 Tricyclic Terpane (T5)	191
C25 Tricyclic Terpane (T6)	191
C24 Tetracyclic Terpane (T6a)	191
C26 Tricyclic Terpane-22S (T6b)	191
C26 Tricyclic Terpane-22R (T6c)	191
C28 Tricyclic Terpane-22S (T7)	191
C28 Tricyclic Terpane-22R (T8)	191
C29 Tricyclic Terpane-22S (T9)	191
C29 Tricyclic Terpane-22R (T10)	191
18a-22,29,30-Trisnorneohopane-Ts (T11)	191
C30 Tricyclic Terpane-22S (T11a)	191
C30 Tricyclic Terpane-22R (T11b)	191
17a(H)-22,29,30-Trisnorhopane-Tm (T12)	191
17a/b,21b/a 28,30-Bisnorhopane (T14a)	191
17a(H),21b(H)-25-Norhopane (T14b)	191
30-Norhopane (T15)	191
18a(H)-30-Norneohopane-C29Ts (T16)	191
17a(H)-Diahopane (X)	191
30-Normoretane (T17)	191
18a(H)&18b(H)-Oleananes (T18)	191
Hopane (T19)	191
Moretane (T20)	191
30-Homohopane-22S (T21)	191
30-Homohopane-22R (T22)	191
T22a-Gammacerane/C32-diahopane	191
30,31-Bishomohopane-22S (T26)	191
30,31-Bishomohopane-22R (T27)	191
30,31-Trishomohopane-22S (T30)	191

Compound	Quant ion m/z
30,31-Trishomohopane-22R (T31)	191
Tetrakishomohopane-22S (T32)	191
Tetrakishomohopane-22R (T33)e	191
Pentakishomohopane-22S (T34)	191
Pentakishomohopane-22R (T35)	191
13b(H),17a(H)-20S-Diacholestane (S4)	217
13b(H),17a(H)-20R-Diacholestane (S5)	217
13b,17a-20S-Methyldiacholestane (S8)	217
14a(H),17a(H)-20S-Cholestane (S12)	217
14a(H),17a(H)-20R-Cholestane (S17)	217
13b,17a-20R-Ethyldiacholestane (S18)	217
13a,17b-20S-Ethyldiacholestane (S19)	217
14a,17a-20S-Methylcholestane (S20)	217
14a,17a-20R-Methylcholestane (S24)	217
14a(H),17a(H)-20S-Ethylcholestane (S25)	217
14a(H),17a(H)-20R-Ethylcholestane (S28)	217
14b(H),17b(H)-20R-Cholestane (S14)	217
14b(H),17b(H)-20S-Cholestane (S15)	217
14b,17b-20R-Methylcholestane (S22)	217
14b,17b-20S-Methylcholestane (S23)	217
14b(H),17b(H)-20R-Ethylcholestane (S26)	217
14b(H),17b(H)-20S-Ethylcholestane (S27)	217
C26,20R- +C27,20S- triaromatic steroid	231
C28,20S-triaromatic steroid	231
C27,20R-triaromatic steroid	231
C28,20R-triaromatic steroid	231

* Peak identification provided in parentheses.

Target Reporting Limit

Sediments/Soil = 2 ug/Kg dry weight
Waters = 10 ng/L

Target Reporting Limit

Oil = 2 mg/Kg

TABLE 1.1f
Suggested Hydrocarbon Groups and Petroleum Biomarkers for Qualitative Analysis

n-Alkycyclohexanes (m/z 83)
n-Alkanes (m/z 85)
Diamondoids (m/z 135, 187)
Sesquiterpanes (m/z 109, 123)
Isoprenoids (m/z 183)
Triterpanes (m/z 191)
Regular Steranes (m/z 217)
Rearranged β,β-steranes (m/z 218)
Methyl steranes (m/z 232, 245)
Methyl and triaromatic steroids (m/z 231)
Monoaromatic steroids (m/z 253)
Diasteranes (m/z 259)

TABLE 1.1g
Corexit Indicator Compounds for Qualitative Analysis in Water Only
(monitoring mass/charge ion)

2-Butoxyethanol (m/z 87, 75)
Glycol ether Isomers (m/z 59, 103)
Bis-(2-ethylhexyl) fumarate (m/z 112, 211)

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 Assessment Manager

Greg Baker
Office of Response and Restoration
NOAA
345 Middlefield Road, MS-999
Menlo Park, CA 94025
(650)329-5048 FAX (650)329-5198
greg.baker@noaa.gov

The Assessment Manager is the designated natural resource trustee representative who is responsible for the review and acceptance of specific work plans and associated QA plans.

2.2 Project Coordinator

Mark Curry
Industrial Economics, Inc. (IEc)
2067 Massachusetts Avenue
Cambridge, MA 02140
(617) 354-0074 FAX (617) 354-0463
curry@indecon.com

The Project Coordinator is responsible for administration of the contracts with the laboratory(ies). The Project Coordinator will oversee the proper scheduling and transmittal of the data from the time of sampling to data reporting.

2.3 Quality Assurance

Ann Bailey is the QA Coordinator reporting directly to the Assessment Manager. Ms. Bailey is responsible for the implementation of this Analytical QA Plan. She will receive assistance in the coordination and performance of laboratory technical audits and independent data validation from the QA Contractor (EcoChem). The QA Coordinator has the authority and responsibility to cease or temporarily halt activities not in keeping with this QA Plan. The QA Coordinator will work closely with laboratory representatives and the project team to assure that project and data quality objectives are met. The QA Coordinator may be reached at:

Ann Bailey
EcoChem, Inc.
710 Second Avenue Suite 660
Seattle, WA 98104
(206)233-9332 x106 FAX (206)233-0114
abailey@ecochem.net

Cheryl Randle is a QA Reviewer conducting data validation on behalf of BP America. Ms. Randle is responsible for working closely with the Assessment Manager's QA Coordinator to assure the validity of the final data in accordance with this Analytical QA Plan. The QA Reviewer will conduct spot

validation of up to 25 percent of the reported data, unless substantial problems are discovered in which case up to 100 percent validation may be performed. The QA Reviewer may be reached at:

Cheryl Randle
ENTRIX, Inc.
1000 Hart Road, Suite 130
Barrington, IL 60010
(847)277-2865 FAX (847)381-6679
crandle@entrix.com

2.4 Analytical Laboratories

The laboratories planned to be contracted at this time for analytical work in support of the NRDA are TDI-Brooks B&B Laboratories (B&B), Newfields/Alpha Analytical (Alpha), and Columbia Analytical Services (CAS). The laboratory project managers are responsible for assuring that all analyses performed meet project and measurement quality objectives. The Laboratory Project Managers are:

Juan Ramirez
TDI-Brooks B&B Laboratories
1902 Pinon
College Station, TX 77845-5816
(979)693-3446 FAX: (979)693-6389
juanramirez@TDI-BI.com

Liz Porta
Alpha Analytical
320 Forbes Boulevard
Mansfield, MA 02048
508-844-4114:
eporta@alphalab.com

Greg Salata, PhD.
Columbia Analytical Services (CAS)
1317 S. 13th Ave.
Kelso, WA 98626
(360)577-7222
gsalata@caslab.com

As additional analytical laboratories are brought under contract this QAP will be updated to include their names and project managers.

3.0 SAMPLE HANDLING AND CHAIN OF CUSTODY PROCEDURES

Chain of custody procedures will be used for all samples throughout the analytical process and for all data and data documentation, whether in hard copy or electronic format. Sampling procedures, including sample collection and documentation, are part of the work plans of the individual projects and as such, are not considered here.

3.1 Sample Preservation and Holding Times

Sample preservation and field treatment of samples for analyses should be described in relevant field work plans. Based on EPA guidance, "advisory" sample holding times prior to analysis and holding times for the extracts are presented below. These holding times may be extended or preservation guidance changed, as options are assessed.

Matrix	Storage for Samples	Holding Time to Extraction	Holding Time to Analysis
Water for PAH, SHC/TEH, Biomarkers	Refrigeration 4°C ±2°; Optional: Preserved with 1:1 HCl to pH<2	7 days if not acid preserved; 14 days if acid preserved	40 days from extraction[12]; except biomarkers no holding time
Water for VOC	Refrigeration 4°C ±2° with no headspace; Optional: Preserved with HCl in the field in VOA vial.	Not applicable	7 days if not acid preserved; 14 days if acid preserved
Sediment for VOC	Refrigeration 4°C ±2°	Not applicable	14 days
Filters for PAH, SHC/TEH, Biomarkers	Frozen	1 Year	40 days from extraction[12]; except biomarkers no holding time
Sediment/Soil for PAH, SHC/TEH, Biomarkers, total solids, grain size and TOC	Frozen, except Grain Size should not be frozen – store at at 4°C ±2°	1 Year, except not applicable for Grain Size, Total Solids, and TOC	40 days from extraction[12]; except biomarkers grain size and TOC no holding time.
Tissue for PAH, SHC/TEH, Biomarkers, and Total Extractable Organics (TEO, aka Lipids)	Frozen	1 Year	40 days from extraction[12]; except biomarkers and TEO no holding time.
Vegetation for PAH, SHC/TEH, Biomarkers	Frozen	1 Year	40 days from extraction[12]; except biomarkers no holding time
Inert Sorbent Material for PAH, SHC/TEH, Biomarkers	Frozen	1 Year	40 days from extraction[12]; except biomarkers no holding time
Oil/Oily Debris for PAH, SHC/TEH, Biomarkers, VOC	Refrigeration <6°C	No holding time	40 days from extraction[12]; except biomarkers no holding time
Water for DOSS	Frozen, 15mL plastic centrifuge tubes	Not established	Not established

[12] 40 days is an advisory extraction holding time. Extracts should be held at -20C in the dark, and may be analyzed past 40 days and results not qualified if surrogates are within criteria.

3.2 Chain of Custody

Chain of custody records will be completed in ink.

A sample is considered in "custody" if:

- it is in the custodian's actual possession or view, or
- it is retained in a secured place (under lock) with restricted access, or
- it is placed in a container and secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s).

Samples are kept in the custody of designated sampling and/or field personnel until shipment.

3.4 Sample Shipping

Any transfer or movement of samples will use chain of custody procedures. The original signed and dated chain of custody record accompanies the sample(s); a copy is retained by the sample shipper. All shipments will comply with DOT regulations (*49CFR, Parts 172 and 173*).

3.5 Sample Receipt

Immediately upon receipt of samples, the recipient will review the shipment for consistency with the accompanying chain of custody record and sample condition, before signing and dating the chain of custody record. Sample condition(s) will be noted on the laboratory's sample receipt form and maintained with the chain of custody records. If there are any discrepancies between the chain of custody record and the sample shipment, the recipient will contact the sample shipper immediately in an attempt to reconcile these differences. Reconciliation of sample receipt differences will be maintained with the chain of custody records and discussed in the laboratory narrative which accompanies the data report.

3.6 Intra-Laboratory Sample Transfer

The laboratory sample custodian or designee will maintain a laboratory sample-tracking record, similar to the chain of custody record that will follow each sample through all stages of laboratory processing. The sample-tracking record will show the name or initials of responsible individuals, date of sample extraction or preparation, and sample analysis.

3.7 Inter-Laboratory Sample Transfer

Transfer of samples from one analytical laboratory to another, e.g. for grain size or TOC analysis, will follow chain of custody, sample shipping and receipt procedures described above. Transfer of samples between laboratories will be noted in the laboratory case narrative which accompanies the data report.

3.8 Sample Archival

All unanalyzed samples and unutilized sample aliquots or extracts will be held by the laboratory in a manner to preserve sample integrity at a secure location with chain of custody procedures for one (1) year after the QA Contractor has validated the data package for that particular set of samples. All archived materials will be accessible for review upon request. At the end of the archival period, the laboratory shall contact the QA Coordinator to obtain directions for handling remaining samples. The samples will not be disposed of by the laboratory unless provided with written approval from the Assessment Manager.

3.9 Data and Data Documentation

The laboratories will provide the QA Contractor with hardcopy data tables, QC documentation and instrument printouts suitable for QA assessment/data validation. Required laboratory deliverables are listed in **Table 7.1**. Data packages will include all related instrument print-outs ("raw data") and bench sheets. A copy of the data and data documentation developed by the laboratory for a given data package will be kept by the laboratory in a secure location using chain of custody procedures for five (5) years after the QA Contractor has validated that data package. All archived data and documentation will be accessible for review upon request. These materials will become the responsibility of the Assessment Manager upon termination of the archival period.

The original data will be transferred from the laboratory to the QA Contractor by means such that a signature is required at the time of document delivery. The QA Contractor will document receipt of packages and maintain a record of the method and date of data submittal with the complete data package. The QA Contractor will maintain the copy of the data packages and related validation documentation in a secure location for a period of one (1) year from the date of validation. These materials will become the responsibility of the Assessment Manager upon termination of the archival period.

4.0 LABORATORY OPERATIONS

All laboratories providing analytical support for the MC252 Damage Assessment must have the appropriate facilities to store and prepare samples, and appropriate instrumentation and staff to provide data of the required quality within the time period dictated. Laboratories are expected to conduct operations using good laboratory practices, including:

- Training and appropriate certification of personnel.
- A program of scheduled maintenance of analytical balances, laboratory equipment and instrumentation.
- Routine checking of analytical balances using a set of standard reference weights (ASTM class, NIST Class S-1, or equivalents).
- Recording all analytical data in secure electronic system with date and associated analyst identification, and/or logbooks with each entry signed and dated by the analyst.
- Monitoring and documenting the temperatures of cold storage areas and freezer units.

Laboratory operations may be evaluated by the QA Coordinator through technical systems audits, performance evaluation studies, and performance in a NIST-managed intercomparison program. Personnel in any laboratory performing analyses for this damage assessment should be well versed in good laboratory practices, including standard safety procedures. It is the responsibility of the laboratory manager and /or supervisor to ensure that safety training is mandatory for all laboratory personnel. The laboratory is responsible for maintaining a current safety manual in compliance with the Occupational Safety and Health Administration (OSHA) or equivalent state or local regulations. Proper procedures for safe storage, handling and disposal of chemicals should be followed at all times; each chemical should be treated as a potential health hazard and good laboratory practices should be implemented accordingly.

4.1 Quality Assurance Documentation

All laboratories must have the latest revision of the MC 252 NRDA Analytical QA Plan. In addition, the following documents and information must be current and available to all laboratory personnel participating in the processing of MC 252 samples:

- Laboratory Quality Assurance Management Plan
- Laboratory Standard Operating Procedures (SOPs) – Detailed instructions for performing routine laboratory procedures.
- Control charts or data tables – These must be developed and maintained throughout the project for appropriate analyses and measurements, including:
    - Alkyl PAH pattern book for MC252 reference oil.

4.2 Laboratory Systems Audits

Prior to or during sample analysis, QA systems audits will be performed. The laboratory audits will be conducted by the QA Coordinator or designee. The checklists used for the laboratory audits are based on requirements outlined in "Good Laboratory Practice Standards" (*40 CFR Part 792*) and audit procedures of the EPA National Enforcement Investigations Center, "NEIC Procedures Manual for the Contract Evidence Audit and Litigation Support for EPA Enforcement Case Development" (*EPA 330/9-89-002*). The Laboratory Project Managers will be informed of the findings and recommendations of the audit before the auditors leave the facility. A written report discussing the audits will be submitted to the Assessment Manager.

Additional laboratory audits may be performed at any time throughout the duration of the NRDA.

4.3 Participation in Intercomparison Exercises

Each analytical laboratory performing analysis will be required to participate in potential intercomparison exercises that may be organized by NS&T and/ or NIST during the duration of the laboratory's participation in this NRDA analytical program. A variety of samples including sample extracts and representative matrices (e.g., sediment or tissue samples) may be utilized in these exercises. Laboratories are required to analyze only those matrices or analytes that they are providing in like manner for the NRDA analytical program. When participating in the intercomparison exercise, the

laboratory should analyze the sample(s) in the same manner as routinely performed for this NRDA and as specified in this Analytical QA Plan. Laboratories which fail to achieve acceptable performance will be required to provide an explanation to the QA Coordinator and/or undertake appropriate corrective actions.

5.0 ASSESSMENT OF DATA QUALITY

The purpose of this Analytical QA Plan is to develop and document analytical data of known, acceptable, and defensible quality. The quality of the data is presented as a set of statements that describe in precise quantitative terms the level of uncertainty that can be associated with the data without compromising their intended use. These statements are referred to as Data Quality Objectives (DQOs) and are usually expressed in terms of precision, bias, sensitivity, completeness, and comparability.

5.1 Precision

Precision is the degree of mutual agreement among individual measurements of the same property under prescribed similar conditions, such as replicate measurements of the same sample. Precision is concerned with the "closeness" of the results. Where suitable reference materials (RMs) are available, precision will be expressed as the relative standard deviation (RSD) for the repeated measurements. This use of RMs allows for the long-term measurement of precision but does not include homogenization as a source of analytical variability.

In addition to the tracking precision of replicate RM analyses, precision will be expressed as the relative percent difference (RPD) between a pair of replicate data from environmental samples prepared and analyzed in duplicate.

5.2 Bias

Bias is the degree of agreement of a measurement with an accepted reference value and may be expressed as the difference between the two measured values or as a percentage of the reference value.

The primary evaluation of bias will be through the use of RMs. RMs with certified values (from NIST or a similar source) will be used if they are available. The laboratory will maintain control charts to track the RM performance. Spiked matrix samples will also be analyzed to assess bias for those analytes that are not available in suitable reference materials.

5.3 Comparability

Comparability expresses the confidence with which one data set can be evaluated in relationship to another data set. Comparability of the chemical analytical data is established through the use of:

- Program-defined general analytical methodology (e.g., low resolution MS), detection limits, bias and precision requirements and reporting formats;

- NIST-traceable calibration materials;
- Reference material with each sample batch;
- Analysis of a common "reference oil".

5.4 Completeness

Completeness is a measure of the proportion of data specified in the sampling plan which is determined to be valid. Completeness will be assessed by comparing the number of valid sample results to the total number of potential results planned to be generated. The DQO for completeness is 95%, i.e. no more than 5% of the analytical data missing or qualified as unreliable (rejected).

6.0 QUALITY CONTROL PROCEDURES

No particular analytical methods are specified for this project, but the QA/QC requirements will provide a common foundation for each laboratory's protocols. This "common foundation" includes: (1) the specification of the analytes to be identified and quantified and the minimum sensitivity of the analytical methods and (2) the use of NIST reference materials, and (3) the use of a common MC252 Reference Oil.

Prior to the analysis of samples, each laboratory must provide written protocols for the analytical methods to be used; calculate detection limits for each analyte in each matrix of interest and establish an initial calibration curve in the appropriate concentration range for each analyte. The laboratory must demonstrate its continued proficiency by participation in refereed intercomparison exercises (as available) and repeated analyses of reference materials, calibration checks, and laboratory method blanks. Laboratories will be expected to take corrective actions promptly if measurement quality objectives described in this plan are not met.

A laboratory may be audited at any time to determine and document that they have the capability to analyze the samples and can perform the analyses in compliance with the QA plan. Independent data validation will be undertaken promptly after analyses of each sample batch to verify that measurement quality objectives are met. The data validator will discuss any unacceptable findings with the laboratory as soon as possible, and assist the laboratory in developing a satisfactory solution to the problem.

6.1 Standard Operating Procedures for Analytical Methods

Prior to the analysis of field samples, each laboratory is required to submit to the QA Coordinator for review and approval, written Standard Operating Procedures (SOPs) detailing the procedures used in sample receipt and handling, sample preparation and analysis, data reduction and reporting. Once approved, the SOPs for each analytical method and from each analytical laboratory will be archived with this plan as part of the QA documentation.

6.2 Determination of Method Detection Limit, Quantitation Range, and Reporting Limits

The analytical laboratory will establish and report a method detection limit (MDL) for each analyte of interest in each matrix, with the exception of oil for which MDLs cannot be accurately determined. The target detection ranges or limits are specified in **Tables 1.1a – 1.1e**. The actual MDLs will be established by following the method in *40CFR part 136*. Results that are less than 5X the MDL or less than the lowest calibration standard will not be required to meet the measurement quality objectives (MQOs) for precision and bias, because these results may be outside the "quantitation range". Thus, these results may be flagged by the laboratory with a J, to indicate the results are possibly an estimate and have not been required to meet the MQOs. If the analyte is not detected in a sample, the result will be reported as non-detected at the MDL and flagged with a "U".

Reporting limits for the supporting analyses (percent moisture, percent total extractable organics [TEO], total organic carbon, and grain size) will be 0.01%. The reporting limit will be demonstrated by the laboratory to be greater than 5X the detection limit.

Target detection limits, as shown at the bottom of **Tables 1.1a through 1.1e**, may not be met due to required dilutions, interferences, and/or limited sample size. If a laboratory MDL does not meet the target detection limit, the reason for the elevated detection limits should be discussed in the laboratory case narrative.

6.3 Quality Control Criteria

MQOs and required minimum frequency of analysis for each QC element or sample type are summarized in **Tables 6.1a – 6.1g**. The analytical laboratory will determine when MQOs have not been met, and perform appropriate corrective actions before continuing the analyses or reporting of the data. If the "Corrective Action" in the Method Performance Criteria table states "Resolve before proceeding", the laboratory must perform an adjustment to the analytical process and subsequently demonstrate the criteria will be met before proceeding with analysis for project samples. In addition, if results associated with a non-compliant QC element have been obtained, the laboratory must repeat those analyses until acceptable QC results are obtained. If the laboratory determines the non-compliance does not affect the quality of the data, the laboratory will discuss the non-compliance and the rationale, used to conclude the data are not affected, in the case narrative which accompanies the data report. If the laboratory determines the non-compliance is due to interferences or circumstances outside the laboratory's control, the laboratory will discuss the reason for the non-compliance in the case narrative and the results reported.

At this time, no criteria for evaluating the target analyte concentrations in the MC252 Reference Oil have been established. Chromatographic resolution criteria for specific compound (peaks) are specified in **Tables 6.1a through 6.1e** and **Table 6.1g** below. When additional criteria are developed they will be added to this Analytical QAP.

TABLE 6.1a
Method Performance Criteria for Extended PAH (Parent and Alkyl Homologs) and Related Compounds

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Tuning	Prior to every sequence	Tune as specified in laboratory SOP	Resolve before proceeding.
Initial Calibration (All parent PAH and selected alkyl homologue PAH)	Prior to every sequence, or as needed based on continuing calibration/verification check.	5-point calibration curve over two orders of magnitude %RSD ≤ 20	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours or every 12 field samples	%D ≤ 25 for 90% of analytes %D ≤ 35 for 10% of analytes	Perform instrument maintenance. Re-analyze affected samples.
Initial Calibration Verification (Second Source or can be met if CCAL is second source)	Per initial calibration	%R target analytes 80-120%	Resolve before proceeding.
Matrix SRM 1941b for sediment; SRM 1974b for tissue	One per batch/every 20 field samples	Within ±20% of NIST 95% uncertainty range for analytes within the quantitation range. 2 analytes may be greater than 20% outside, however average %D must be <35%	Resolve before proceeding.
Oil SRM 1582 (Oil and Water only)	One per batch of oil/every 20 field samples	Within ±20% of NIST 95% uncertainty range for analytes within the quantitation range. 2 analytes may be greater than 20% outside, however average %D must be <35%	Resolve before proceeding.
MC 252 Reference Oil	One per batch/every 20 field samples	Peak resolution >80% of 9-methylphenanthrene from 1-methylphenanthrene (m/z 192). Plus additional criteria to be developed.	Resolve before proceeding.
Matrix Spike/Matrix Spike Duplicate (Sediments, Soils, Tissues only)	One per batch/every 20 field samples	%R 50% - 125% for target analytes detected at >5X the spiked amount; RPD ≤30%, except biphenyl (40%-140%) and decalin (25%-125%)	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Blank Spike/Blank Spike Duplicate (Aqueous Samples)	One per batch/every 20 field samples	%R 50% - 125% for target analytes, RPD ≤30%, except biphenyl (40%-140%) and decalin (25%-125%)	Resolve before proceeding.
Procedural Blank	One per batch/every 20 field samples	No more than 2 analytes to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedance'.
Sample Duplicate (not required for water matrix)	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, and determine if corrective action is needed.
Mass Discrimination	Initial calibration and CCVs (mid-level)	Ratio for the concentration of Benzo[g,h,i]perylene to phenanthrene ≥0.70	Resolve before proceeding.
Internal Standard (IS)	Every sample	50% - 200% of the area of the IS in the associated calibration standard	Resolve before proceeding.
Surrogates	Every sample	%R 40-120% except d12-perylene which is 10-120%	Re-extract affected samples. Evaluate impact to data, discuss with manager, if corrective action is needed.

TABLE 6.1b
Method Performance Criteria for Alkanes/Isoprenoids Compounds and Total Extractable Hydrocarbons

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Initial Calibration (Standard solution - all target analytes, except phytane, and C_{31}, C_{33}, C_{35}, and C_{39} n-alkanes)	Prior to every sequence, or as needed based on continuing calibration/verification check.	5-point calibration curve %RSD ≤ 20	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours or every 12 field samples	%D ≤ 15 for 90% of analytes %D ≤ 20 for 10% of analytes	Perform Instrument Maintenance. Re-analyze affected samples.
Initial Calibration Verification (Second Source or can be met if CCAL is second source)	Per initial calibration	%R target analytes 80-120%	Resolve before proceeding.
SRMs - no SRMs for SHC or TPH are available at this time			
MC 252 Reference Oil	One per batch/every 20 field samples	Peak resolution >80% of n-C17 from pristane; Add'l criteria to be developed.	Resolve before proceeding.
Matrix Spike/Matrix Spike Duplicate (Sediments, Soils, Tissues only)	One per batch/every 20 field samples	%R 50% - 125% for target analytes detected at >5X the spiked amount; RPD ≤30%.	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Blank Spike/Blank Spike Duplicate (Aqueous Samples)	One per batch/every 20 field samples	%R 50% - 125% for target analytes, RPD ≤30%.	Resolve before proceeding.
Procedural Blank	One per batch/every 20 field samples	No more than 2 analytes to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedances'.
Duplicate Sample Analysis (not required for water matrix)	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Mass Discrimination	Initial calibration and CCVs (mid-level)	Ratio for the raw areas of n-C36 / n-C20 ≥0.70	Resolve before proceeding.
Surrogates	Every sample	%R 40-125%	Re-extract affected samples. Evaluate impact to data, discuss with manager, determine if corrective action is needed.

TABLE 6.1c
Method Performance Criteria for VOCs

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Tuning	Prior to every sequence	Per SW846 8260B	Resolve before proceeding
Initial Calibration (ICAL)	Prior to every sequence, or as needed based on continuing calibration/verification check.	Minimum of 5 concentration levels %RSD ≤ 25% for 90% of analytes %RSD ≤ 35% for all analytes >C6	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours or every 12 field samples	%D ≤ 25% for 90% of analytes %D ≤ 35% for all analytes >C6 Except t-butanol <50%	Perform Instrument Maintenance. Re-analyze affected samples.
Initial Calibration Verification (Second Source or can be met if CCAL is second source)	Per initial calibration	%R target analytes 80-120%. Except 2 analytes can be at 60 - 140%	Resolve before proceeding.
SRMs – No SRMs are available at this time			
MC 252 Reference Oil	One per batch/every 20 field samples	To Be Determined	Resolve before proceeding.
Matrix Spike/Matrix Spike Duplicate (Sediments, Soils)	One per batch/every 20 field samples	%R 50% - 130% for target analytes detected at >5X the spiked amount; RPD ≤30%.	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Blank Spike/Blank Spike Duplicate (Aqueous Samples)	One per batch/every 20 field samples	%R 50% - 130% for target analytes, RPD ≤30%.	Resolve before proceeding.
Procedural Blank	One per batch/every 20 field samples	No more than 2 analytes to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedances'.
Sample Duplicate	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Internal Standard (IS)	Every sample	50% - 200% of the area of the IS in the associated calibration standard	Resolve before proceeding.
Surrogates	Every sample	%R 70-130%	Re-extract or re-analyze affected samples. Evaluate impact to data, discuss with manager, determine if corrective action is needed.

TABLE 6.1d
Method Performance Criteria for Quantitative Biomarkers

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Tuning	Prior to every sequence	Tune as specified in laboratory SOP	Resolve before proceeding.
Initial Calibration	Prior to every sequence, or as needed based on continuing calibration/verification check.	5-point calibration curve over two orders of magnitude %RSD ≤ 20	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours or every 12 field samples	%D ≤ 25 for 90% of analytes %D ≤ 35 for 10% of analytes	Perform instrument maintenance. Re-analyze affected samples.
Oil SRM 1582 (Oil and Water only)	One per batch of oil/every 20 field samples	Biomarker concentrations are not certified; Peak resolution (*m/z* 191) of: (a) oleanane (T18) from hopane (T19); (b) C26 Tricyclic Terpane stereoisomers 22R (T6b) from 22S (T6c) and from C24 Tetracyclic Terpane (T6a)	Resolve before proceeding.
MC 252 Reference Oil	One per batch/every 20 field samples	Peak resolution (*m/z* 191): 30-Norhopane (T15) from 30-Norneohopane (T16) from Diahopane (X). Add'l. criteria To Be Determined.	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	No more than 2 analytes to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedance'.
Sample Duplicate	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, and determine if corrective action is needed.
Internal Standard (IS)	Every sample	50% - 200% of the area of the IS in the associated calibration standard	Resolve before proceeding.
Surrogate	Every sample	%R 50-130%	Evaluate impact to data, discuss with manager, if corrective action is needed.

TABLE 6.1e
Method Performance Criteria for Qualitative Biomarkers

Element or Sample Type	Minimum Frequency	Measurement Quaiity Objective/ Acceptance Criteria	Corrective Action
Oil SRM 1582 (Oil and Water only)	One per batch of oil/every 20 field samples	Peak resolution (m/z 191) of: (a) oleanane (T18) from hopane (T19); (b) C26 Tricyclic Terpane stereoisomers 22R (T6b) from 22S (T6c) and from C24 Tetracyclic Terpane (T6a)	Resolve before proceeding.
MC 252 Reference Oil	One per batch/every 20 field samples	Peak resolution (*m/z* 191): 30-Norhopane (T15) from 30-Norneohopane (T16) from Diahopane (X). Add'l. criteria To Be Determined.	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	No interference with biomarker patterns	Resolve before proceeding. QA coordinator may be contacted to resolve issues surrounding 'minor exceedance'.
Sample Duplicate	One per batch/every 20 field samples	Qualitative comparison meets laboratory SOP	Evaluate impact to data, discuss with manager, and determine if corrective action is needed.

TABLE 6.1f
Method Performance Criteria for General/Conventional Chemistry

Conventional Sediment Parameters: Total Organic Carbon (TOC), Grain Size, Total Solids
Tissues: Total Extractable Organics (TEO)

QC Element or Sample Type	Minimum Frequency	Acceptance Criteria	Relevant Parameter(s) Reference Methods*
Initial Calibration	Prior to analysis (method and instrument specific procedures & number of standards)	For multipoint calibration, Correlation coefficient (r) >0.995	TOC
Continuing Calibration	Must start and end analytical sequence and every 10 samples	%R 90%-110%	TOC
Method Blanks	One per batch/every 20 field samples	Not to exceed QL	TOC, TEO
Blank Spike Samples	One per batch/every 20 field samples	%R 75% - 125%	TOC
Matrix Spike Samples	One per batch/every 20 field samples	%R 75% - 125% If MS/MSD analyzed, RPD ≤ 25%	TOC
Replicate Analyses[13]	Each sample must be analyzed at least in duplicate. The average of the replicates shall be reported.	RPD or %RSD < 20% for concentrations > QL	TOC
Sample Duplicates[14]	One per batch/every 20 field samples	RPD ≤ 25% for analyte concentrations greater than QL	TOC, Grain Size, TS, TEO
Reference Materials TOC NIST 1941B TEO NIST 1974B	One per batch/every 20 field samples	Values must be within ±20% of NIST uncertainty range	TOC, TEO

* Reference Methods

TOC	Plumb 1981/SW 846 Method 9060A
Grain Size	ASTM D422. If using sieve analysis only, report as percent gravel, coarse sand, medium sand, fine sand, very fine sand, and silt/clay. If using sieve and hydrometer, report as percent gravel, coarse sand, medium sand, fine sand, very fine sand, silt, and clay.
TS (percent)	EPA 160.3

Method 9000 series - analytical methods from SW-846 (U.S. EPA 1986) and updates
The SW-846 and updates are available from the web site at: http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm
Plumb (1981) - U.S. EPA/U.S. Army Corps of Engineers Technical Report EPA/CE-81-1 :
http://yosemite.epa.gov/r10/CLEANUP.NSF/ph/T4%20Technical%20Documents/$FILE/Plumb.pdf

[13] Method SW9060 requires quadruplicate analyses, however duplicate or triplicate analyses are acceptable.

[14] Method SW9060 requires a duplicate spike. A matrix spike and sample duplicate are acceptable in lieu of matrix spike/matrix spike duplicates. For grain size, RPD criteria only applied if fraction is greater than 5%.

TABLE 6.1g
Draft Method Performance Criteria for Analysis of Dioctylsulfosuccinate sodium salt (DOSS)

Element or Sample Type	Minimum Frequency	Measurement Quality Objective/ Acceptance Criteria	Corrective Action
Initial Calibration	Prior to every sequence, or as needed based on continuing calibration/verification check.	5-point calibration curve over two orders of magnitude %RSD ≤ 20	Resolve before proceeding.
Continuing Calibration (CCAL)	Every 12 hours	%D ≤ 30	Perform instrument maintenance. Re-analyze affected samples.
Initial Calibration Verification (Second Source or can be met if CCAL is second source)	Per initial calibration	%R target analytes 70-130%	Resolve before proceeding.
MC 252 Reference Oil	One per batch/every 20 field samples	Criteria to be developed	Resolve before proceeding.
Matrix Spike/Matrix Spike Duplicate (Sediments, Soils, Tissues only)	One per batch/every 20 field samples	%R 50% - 125% if sample concentration detected at >5X the spiked amount; RPD ≤30%	Evaluate impact to data, discuss with manager, determine if corrective action is needed.
Blank Spike/Blank Spike Duplicate (Aqueous Samples)	One per batch/every 20 field samples	%R 50% - 125; RPD ≤30%	Resolve before proceeding.
Method Blank	One per batch/every 20 field samples	Not to exceed 5x target MDL unless analyte not detected in associated samples(s) or analyte concentration >10x blank value	Resolve before proceeding.
Sample Duplicate (not required for water matrix)	One per batch/every 20 field samples	RPD ≤ 30% if analyte concentration is greater than QL	Evaluate impact to data, discuss with manager, and determine if corrective action is needed.
Internal Standard (IS)	Every sample	50% - 200% of the area of the IS in the associated calibration standard	Resolve before proceeding.
Surrogates	Every sample	%R 40-120%	Re-extract affected samples. Evaluate impact to data, discuss with manager, if corrective action is needed.

6.3.1 Initial Calibration

Acceptable calibration (initial and continuing) must be established and documented before sample analyses may begin. NIST-traceable calibration materials must be used where available in establishing calibration. Initial calibrations will be established according to the criteria in **Tables 6.1a – 6.1d , 6.1f and 6.1g**. A specific requirement for this project is to use methodology (and tune instrumentation) for low detection limits, therefore, samples with analytes above the calibration range will be diluted and reanalyzed. If samples require a dilution, results from the initial analytical run that were within the calibration range should be reported. Results from the diluted analyses should be reported for only those analytes which exceeded the calibration. .

6.3.2 Continuing Calibration Verification

Continuing calibration verification (CCV) standards will be run at the frequencies indicated in **Tables 6.1a – 6.1d, 6.1f and 6.1g**. If CCV results do not meet the specified criteria, then the instrument must be re-calibrated and all samples analyzed since the last acceptable CCV must be re-analyzed.

6.3.3 Reference Materials

Reference materials of a matrix appropriate to the samples being analyzed, will be analyzed every 20 samples throughout the analytical program, if available. The data resulting from the analysis of these samples will be reported in the same manner as that from the field samples. These data will be the prime materials used to determine and document the accuracy and precision of the associated field sample data. The reference materials to be used are listed in the criteria tables.

Accuracy is computed by comparing the laboratory's value for each analyte against either end of the range of values reported by the certifying agency. The laboratory's value must be within 20% of either the upper or lower end of NIST's 95% uncertainty range. For oil, water, filters, and inert sorbent materials analyses, the SRM is not extracted, but analyzed only on the instrument. The MC252 Reference Oil will be run with each batch of samples (e.g., GU2988-A0521-O9805 or equivalent as approved by the QA Coordinator). Chromatographic resolution criteria of selected peak pairs in the Reference Oil are indicated in **Tables 6.1a-6.1e**. After initial data sets are acquired, additional criteria for the Reference Oil will be determined.

6.3.4 Method Blanks

Method blanks are laboratory derived samples which have been subjected to the same preparation or extraction procedures and analytical protocols as project samples. A method blank will be analyzed with every 20 field samples analyzed. Acceptance criteria are provided in **Tables 6.1a – 6.1g**. Failure to meet acceptance criteria requires definitive corrective action to identify and eliminate the source(s) of contamination before the subsequent reanalysis and re-extraction of the blank and affected samples. Sample results will not be blank corrected.

6.3.5 Sample Duplicates

A duplicate sample aliquot from a representative matrix will be prepared and analyzed with every 20 field samples, except for water samples, filters, and inert sorbent materials for SHC/TEH and PAH. Water samples, filters and inert sorbent materials for SHC/TEH and PAH will not be analyzed in

duplicate because of the difficulty in subsampling representative aliquots. If duplicate VOA vials are collected, then volatile organic analyses may be performed in duplicate. Acceptance criteria the other matrices are provided in **Tables 6.1a – 6.1g**.

6.3.6 Matrix Spike/Matrix Spike Duplicates or Blank Spike/Blank Spike Duplicate

Matrix spike/matrix spike duplicates (MS/MSDs) will be analyzed every 20 samples, except for water samples, filters and inert sorbent materials. MS/MSDs will not be analyzed with the water sample batches because of the difficulty in subsampling representative aliquots from a sample container. Instead, blank spike/blank spike duplicates (BS/BSDs) will be analyzed with each batch of water samples. Samples will be spiked prior to extraction. Spike solution concentrations for the MS must be appropriate to the matrix and anticipated range of contaminants in the sample; that is 2 to 10 times analyte concentration. However, because it is not possible to know the concentration of contaminants prior to analysis, professional judgment may be exercised in choosing concentrations that are reasonable under the circumstances.

6.3.7 Internal Standards

All samples will be spiked with internal standards prior to analysis, when required by the analytical method. Control criteria for internal standard recovery are listed in **Tables 6.1a – 6.1d, and 6.1g**.

7.0 DATA REDUCTION, VALIDATION AND REPORTING

7.1 Data Reduction

Data reduction is the process whereby raw data (analytical measurements) are converted or reduced into meaningful results (analyte concentrations). This process may be either manual or electronic. Primary data reduction requires accounting for specific sample preparations, sample volume (or weight) analyzed, and any concentrations or dilutions required.

Primary data reduction is the responsibility of the analyst conducting the analytical measurement and is subject to further review by laboratory staff, the Laboratory Project Manager and finally, independent reviewers. All data reduction procedures will be described in the laboratory SOPs. Any deviations from the laboratory SOPs will be discussed in the laboratory case narratives.

- Concentrations will be reported as if three figures were significant.
- Data generated from the analysis of blank samples will not be utilized for correction of analyte data.
- Surrogate compounds, matrix spikes, and spike blanks will be evaluated as %R.
- Reference materials will be reported in units indicated on the certificate of analysis.
- Continuing calibration factors will be presented as %D
- Duplicate sample results will be expressed as RPD.

7.2 Data Review and Validation

Data review is an internal review process where data are reviewed and evaluated by personnel within the laboratory. Data validation is an independent review process conducted by personnel not associated with data collection and generation activities.

Data review is initiated at the bench level by the analyst, who is responsible for ensuring that the analytical data are correct and complete, the appropriate SOPs have been followed, and the QC results are within the acceptable limits. The Laboratory Project Manager has final review authority. It is the Laboratory Project Manager's responsibility to ensure that all analyses performed by that laboratory are correct, complete, and meet project data quality objectives.

External and independent data validation will be performed for all samples by the QA Contractor using a full data package containing sufficient information to allow the independent validation of the sample identity and integrity, the laboratory measurement system, and resulting quantitative and qualitative data. The required information with associated instrument print-outs are listed in **Table 7.1**.

TABLE 7.1 Laboratory Data Deliverables Per Sample Batch

Chain-of-Custody/ Sample Receipt Checklist	
Sample Data:	Result summaries including surrogate recoveries, percent total solids, dilutions, etc
Standards Data:	Target MDL data based on the method in *40 CFR, 136* Calibration summaries: Initial calibration data, standard curve equation, correlation coefficient or %RSD, continuing calibration %D.
Quality Control Data (Method Blanks, CRMs, Duplicates, Matrix Spikes, Spike Blanks):	Results summaries including surrogate recoveries, plus %R and RPD, as applicable.
Case Narrative:	Special handling or analysis conditions. Any circumstance that requires special explanation such as an exception to QA/QC conditions or control criteria, dilutions, reanalysis, etc. Corrective actions/procedure alterations
Chromatograms and Extracted Ion Profiles	Appropriately scaled (1) GC/FID chromatograms for samples and associated QC analyzed for extractable hydrocarbons; (2) GC/MS EIPs for samples and associated QC analyzed for qualitative biomarkers
Electronic Data Deliverable:	As specified in laboratory contract.

Three levels of data validation will be performed (see USEPA, *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. EPA-540-R-08-005. January 2009 for definitions): full (stage 4), summary (stage 2B), or cursory (stage 2A) validation. Full validation will consist of a review of the entire data package for compliance with documentation and quality control criteria for all the following items, plus recalculations of instrument calibration curves, sample and QC results. Summary validation will consist of a review of all the following items, but without recalculations. Cursory validation will consist of a review of only the starred (*) items:

- Package completeness*
- Holding times from extraction to analysis*
- Instrument calibration, initial and continuing
- Blank results*
- Instrument performance
- Spike recoveries*
- Standard reference material results*
- Laboratory duplicate results*
- Reported detection limits*
- Compound quantitation
- Compound identification
- Verification of electronic data deliverable (EDD) against hardcopy (10% verification)*

As the project proceeds and the quality of the data is verified and documented, the level of validation will decrease at the discretion of the QA Coordinator. At a minimum, cursory validation will be performed on all data packages, i.e., only the starred items will be reviewed.

Qualifiers (**Table 7.2**) may be assigned to individual data points by the QA Contractor. These validation qualifiers will not replace qualifiers or footnotes provided by the laboratory, but will be added to the data summary tables to inform the data user whether or not the data met all project quality objectives. Both sets of qualifiers will be maintained in the database.

TABLE 7.2 Data Validation Qualifier Codes

U	Analyte concentration is not significantly greater than the associated blank result. The result is judged to be the detection limit.
R	Unreliable result. Data should not be used.
N	The analysis indicates the present of an analyte for which there is presumptive evidence to make a "tentative identification".
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.
J	Reported concentration is an estimate with potentially more bias, or less precision than an unqualified concentration, as judged by associated calibration and/or reference material results.
UJ	Not detected. Detection limit is an estimate with potentially more bias or less precision than an unqualified detection limit as judged by the associated quality control results
DNR	Do not report; A more appropriate result is reported from another analysis or dilution.
F	Found. Analyte detected at less than the MDL, however, peak height is greater than 3 times the noise level and ID criteria are met.

All discrepancies and requests for additional corrected data will be discussed with the laboratory prior to issuing the formal data validation report. Review procedures and findings during data validation will be documented on worksheets. A validation report will be prepared for each data group/data package summarizing QC results, qualifiers, and possible data limitations. Only validated data with appropriate qualifiers will be released for general use. Data are not considered final until QA Coordinator has performed assessment and accepted the data.

In addition, the validated data will be reviewed by the QA Reviewer on behalf of BP America. The following process shall be used should the independent validation of the laboratory data results in a material difference in how qualifiers have been assigned or in the actual value itself:

- The QA Coordinator and QA Reviewer will meet to determine the source of the difference, and resolve. No changes to validated results will be made if the differences are considered immaterial to both the QA Coordinator and QA Reviewer.
- If the validated data have already been released by the QA Coordinator, then the data will be updated in accordance with the resolution and reposted.
- Should there be no agreement on how to resolve the difference, the QA Coordinator and QA Reviewer shall request further assistance from the Assessment Managers and BP America, respectively.
- The basis for all material changes to validated results will be documented along with the resubmitted validated data.

8.0 CORRECTIVE ACTION AND PROCEDURE ALTERATION

The analytical laboratories are required to adhere to the SOPs submitted by them to the QA Coordinator for this project. When the data from the analyses of any quality control sample exceeds the project specified control limits or indicates that the analytical method is drifting out of control, it is the

immediate responsibility of the analyst to identify and correct the situation before continuing with sample analysis.

A narrative describing the problem noted, the steps taken to identify and correct the problem and the treatment of the relevant sample batches must be prepared and submitted with the relevant data package. If the action indicates a revision to the accepted SOP is warranted, the laboratory will revise the SOP and resubmit the SOP to the QA Coordinator within 30 working days after the problem was noted. Until the revised SOP is approved, any data sets reported with the revised method will have the any changes to the method noted in the laboratory's case narrative.

9.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Quality Assurance/Quality Control (QA/QC) reports will be submitted periodically to the Assessment Manager(s) by the QA Coordinator. These reports may be either formal or informal in response to the Assessment Manager's request. Upon termination of the analytical work for this damage assessment, a formal QA report will be submitted. This report will include:

- General compliance with QA objectives
- Summary of technical and performance evaluation audits
- Summary of data validation reports
- Summary of laboratory control charts

10.0 REFERENCES

Bence, A.E., K.A. Kvenvolden, and M.C. Kennicutt, II. 2006. Organic geochemistry applied to environmental assessments of Prince William Sound, Alaska, after the Exxon Valdez oil spill--a review. *Org. Geochem.* 24(1):7-42.

Pu, F., R.P. Philp, L. Zhenxi and Y. Guangguo. 1990. Geochemical characteristics of aromatic hydrocarbons of crude oils and source rocks from different sedimentary environments. *Org. Geochem.* 16(1-3):427-443.

USEPA, 2002. *Guidance for Quality Assurance Project Plans*, (EPA QA/G-5) EPA/240/R-02/009, December 2002. http://www.epa.gov/quality/qs-docs/r5-final.pdf

USEPA, 2001. *EPA Requirements for Quality Assurance Project Plans*, (EPA QA/R-5) EPA/240/B-01/003, March, 2001. http://www.epa.gov/quality/qs-docs/q5-final.pdf

NRDA Field Sampler Data Management Protocol

10-22-2010

MS Canyon 252 (Deepwater Horizon) Oil Spill

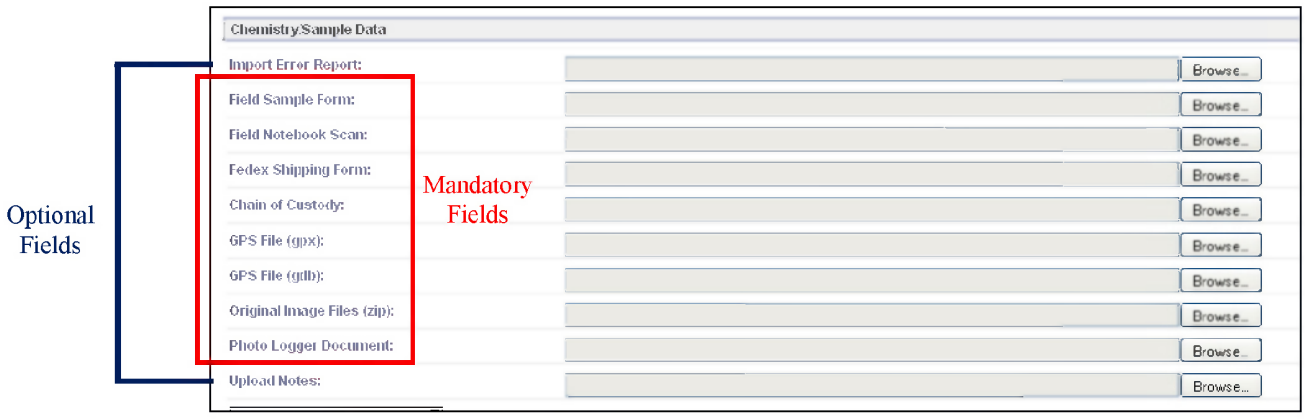
NOTE: THESE INSTRUCTIONS REPLACE ALL PREVIOUS INSTRUCTIONS.

These instructions update the protocol for preparing field sample records and uploading field sampling data into NOAA's NRDA Content Management System (www.noaanrda.org) and match the sampling forms version 16.2.1 updated in July 2010. NRDA samples submitted for chemistry must comply with the documentation requirements set forth in the NOAA field sampling form documentation and outlined below. Samples that do not meet these requirements will not be processed by the laboratory. Individuals who submit samples that do not comply with documentation requirements will be instructed on proper procedures and be given the opportunity to correct any deficiencies; however, this will delay data acquisition. This system was developed with both legal and scientific considerations. Prior to undertaking any sampling, please familiarize yourself with all of the required data elements on the forms relevant to your effort. These documentation requirements are relevant to all work groups, with the exception of the sub-surface multi-depth water sampling conducted on research cruises, which is subject to its own documentation requirements (see Cruise Data Protocol document).

A weekly Q&A session for field samplers (Wednesday at 4pm CDT) goes through the contents of this protocol. Please join the webinar if you are new to NRDA Field Sampling or if you have questions about field sampling protocol. The number to call in to the webinar is 866-763-3375 and the Participant Code is 9557764, and the webinar is presented at https://www1.gotomeeting.com/join/454999441

NRDA Sample Data Requirements

All analytical sample data must be submitted through the NOAA NRDA Content Management System. A complete file collection must include those listed as Mandatory in the graphic below. In the event that all Mandatory files are not uploaded, the sampling event will not be included the database and you will be notified by a representative from the NRDA Data Management team. The only optional fields include Import Error Report and Upload Notes.



To gain access to the NOAA NRDA Content Management Site, users must request access via support@noaanrda.org or call (866) 974-0614. Each component of a complete file collection is discussed below.

Field Sample Documentation

The NRDA Field Sample Form and related guidance documents are located on the NOAA NRDA site (*Documents* > *Field Sample Form*). When a sample is collected for chemical analysis, the following documentation is required and must be provided in order for the samples to be accepted for analysis:

- **Sample collection information**: **All** fields on the applicable NRDA Sample Collection Form (Oil-Tarball-Water, Soil-Sediment, or Tissue-Wrack) must be filled out, with the exception of those fields noted below. There are three options to record this required information:
    a. Use the matrix-specific NRDA Sample Collection Forms;
    b. Record **all** the required information on paper (e.g, other form, log book); or
    c. Record **all** the required information directly into a spreadsheet.
- **NRDA Chain of Custody (CoC) Form**: Complete all fields in the COC form with the exception of the fields noted below. NOTE: Written documentation must be in the NRDA format for this project.
- **Field log books:** If a log book is used, either the log book must be submitted for scanning or appropriate scanned pages must be delivered with the samples. Originals may be demanded in the future; they must be kept by your agency or turned in to the SIC or other NOAA representative.

All data fields on the forms are to be ***completely*** filled out. Exceptions to the data field requirements are very limited:

- NRDA CoC form
    - Analyses Requested (if uncertain, select "As per sample plan" in picklist)
    - Lab Name (if unknown, please write "Lab")
    - Waybill Number (Laboratory will fill in if coolers are sealed prior to obtaining waybill number)
    - Turn Around Time
- NRDA Sample Collection Forms
    - Resource Group Leader (Preferred, but not legally required)
    - Chain of Custody Field CoC information (Only if an intermediary delivers samples from sample site to SIC)
    - Notes sections (The notes sections are not mandatory; however samplers are encouraged to use these sections to provide additional detail.

Pre-Field Sampling Protocol

I. Before going into the field for the first time, the NRDA field sampler should watch the sample training videos and review the Field Form User Guide (Documentation > Sampling Training Session). Any outstanding questions can be addressed via email (dwhnrda@gmail.com), the **Field Sample Form helpline at (985) 746-1394**, or through attending the weekly Q&A session. This explains the official NOAA NRDA field sampling form.

II. Before going into the field *each day*, the NRDA field samplers should generally complete two tasks.

1. Print necessary field sampling forms (*Documentation > Field Sampling Form*).

2. Determine your NRDA Sampling Grid Location Code (*Documentation > NRDA Grid Location Code Maps*).

Near-Shore/Land Sampling:
a. Choose the index map for the state in which you will be sampling.
b. Find the sampling grid map corresponding to the specific area in which you will be working.
(*Documentation > NRDA Grid Location Code Maps*)

c. Use the sampling grid map to find the grid in which you will be working. The codes are noted in the center of each cell.

Water-Based Sampling:
Given the extent of the Gulf activities, for open water-based sampling please use the following convention:
- GU (for Gulf of Mexico) or EC (for East Coast, east of the Florida Keys)
- Degree Latitude
- Degree Longitude

For example, in the Gulf of Mexico sampling location 27.30 North and -88.30 West code would be GU2788.

Sample Collection Information Options

With every chemistry sampling event, the information on both the matrix-specific NRDA Sample Collection Forms and the NRDA Chain of Custody Form must be collected. For legal defensibility, original copies of all documents must be retained. Individual agencies may choose to retain custody of these documents (field forms, log books) and

provide only electronic copies to NOAA; in this case, the individual agency is responsible for providing the material in the event of a discovery request. Alternatively, the original documents may be signed over to NOAA and its contractors, and will be retained in secure document storage.

Some sampling teams may find it convenient or necessary to use formats besides the NRDA Sampling Collection Form to capture this information. There are three options to record this information. If you do multiple days of sampling, you need to fill out one electronic field form per day.

1. ***Use the NRDA Sample Collection Form for the specific matrix you are working with*** (strongly recommended option). The three NRDA Sample Collection Forms are:
   - Oil/Tarball/Water (use separate forms to track water versus oil/tarball)
   - Tissue/Wrack
   - Soil/Sediment

   The completed original NRDA Sample Collection Form is turned in with the samples when using a Sample Intake Center (SIC). If the sampling team is not using a SIC, the data from this form are entered electronically into either the MS Excel-based Field Sample Workbook or Flat File forms and uploaded to the NOAA NRDA site. Copies of the hand-written form must be scanned and uploaded to the NOAA NRDA site with the data spreadsheet. Originals may be retained by individual agencies or submitted in hard-copy via a traceable carrier (e.g. U.S. registered mail, FedEx, UPS or similar) to the NRDA document manager:

   NRDA Document Manager
   c/o Industrial Economics
   2067 Massachusetts Avenue
   Cambridge, MA 02140

2. ***Use a form other than the NRDA Sample Collection Form for recording the required information.*** The information can be recorded on another form or in a field log book. It is imperative that **all** required fields from the NRDA Sample Collection Form be recorded (see above requirements). When using a form other than the NRDA Sample Collection Form, the original form or field log book must be turned into the SIC. If the sampling team is not using a SIC, the data from the form or field log book are entered electronically into either the MS Excel-based Field Sample Workbook or Flat File forms and uploaded to the NOAA NRDA site. Copies of the hand-written form must be scanned and uploaded with the data spreadsheet. Originals may be retained by individual agencies or submitted in hard-copy to the NRDA document manager (see address above).

3. ***Use a computer to input the information directly into a spreadsheet.*** The required information from the NRDA Sample Collection Form can be recorded directly into a computer provided the following steps are followed:
   a. The computer file is recorded on a CD/DVD (non-rewritable) at the end of each field day.
   b. The following is recorded on the CD/DVD label:
      i. Name of person entering data into the computer system
      ii. Date of sample collection/data input
      iii. Make and serial number of the computer
      iv. Software used and version number
   c. A NRDA Chain of Custody is completed for transfer of the CD/DVD
   d. The files on the CD/DVD are uploaded to the NOAA NRDA website.

   The original file is kept on the computer system until it is verified that the CD/DVD recorded properly. This CD/DVD is turned in with the samples if using a SIC. If the sampling team is not using a SIC, this CD/DVD must be sent to the NRDA document manager under chain of custody (i.e., with a CoC form and using a secure carrier such as FedEx).

If you have questions or need assistance with the workbook please first look for the answer in the User Guide, then try to attend the weekly webinar. If you cannot attend the webinar, you may call the field sampling form/COC **helpline number at (985) 746-1394**. Again, general questions regarding the forms may posted to NRDA Gmail address (dwhnrda@gmail.com): inquiries are usually responded to within 24 hours.

Regardless of which reporting approach you choose, name the file using the following naming convention. The date is the **date sampled** (if multiple sampling days *on cruises only*, use the last day of samples).

<<YYYY>>_<<MMDD>>_<<LAST NAME>>_<<FIRST_NAME>>_<<FILE_TYPE>>.xls

For example:
2010_0701_SMITH_JOHN_FieldSampleForm.xls

Scanning Field Form Documents

Scans of all paper forms used in the field and any log book entries must be included in the file collection upload. All sample intake centers have scanners.

Chain of Custody (COC) Forms and Mailing Labels

Please scan your ***signed*** COC forms and mailing labels. Note that the NOAA Spreadsheet will create a custom COC form based on your inputs. NOAA NRDA samples require the use of the NOAA NRDA COC.

Photos and GPS

Photos are taken in the field for two primary reasons: to validate the field sampling effort and to provide a visual description of field conditions and operations. The GPS is required to geo-locate the photos to a particular time and place for legal reasons. Samples will be accepted without photo documentation, but any submitted photos must follow the NRDA documentation requirements.

Pre-Field Photo/GPS Protocol

I. Read through the field photo validation documents located on NOAA NRDA (*Documentation > Photos and GPS*) which include: NRDA Field Photography Guidance, Basic GPS Skills and Garmin MapSource

II. Make sure digital camera has charged batteries, is set to a high resolution, and uses JPEG file format (not RAW).

III. Set the camera to local time and date; the time should be in 24h military time.

IV. Have a back up of all past information, and clear camera and GPS before each sampling day.

V. Set the GPS to Datum - WGS 1984, 24h military time with the correct time and date, set the track log to "wrap when full", and make sure the GPS is set in decimal degrees. The batteries for the GPS should also be fully charged.

Field Photo and GPS Protocol

I. Turn on your GPS. Leave it on for the entire sampling day.

II. Take one photo of your GPS screen which displays the time (including seconds) and date clearly. Make sure the GPS screen is clear in the photo. This will be used with the GPS track log to geo-locate the photos.

III. Take photos of the field samples and sampling effort. Remember, for legal reasons, do not delete or rename photos.

Post-Field Photo and GPS Protocol

I. Download your photos from that day's sampling only. Place them in a folder called Photos to be included in the zip file. Do not open, delete or rename any of the photos. If you wish to view your photos, you may download them again to your own personal folder and view them. Sample Intake Centers can also upload your photos.

II. Download the GPS Track Log and way points using Garmin MapSource. Save the points twice from MapSource: once as a Garmin Database file (.gdb) and once as a GPS exchange file (.gpx). If you have other non-Garmin GPS/latitude longitude information, please provide GPS locations in a format (e.g., excel) that links the photo name with its coordinates. If the field locations are staffed with members of the data management team, they can assist you with this process.

III. Fill out the NRDA Photo Logger form. This is required and located on NOAA NRDA *(Documentation > Photos and GPS*). Without the form, the data management team will not be able to log your photos.

Uploading the File Collection to the NOAA NRDA Website

Naming Convention for Uploaded Files

Naming files in a consistent way will greatly speed up the processing of the sampling information. Please use the following naming convention (the date field representing the sample date):

<<YYYY>>_<<MMDD>>_<<LAST NAME>>_<<FIRST_NAME>>_<<FILE_TYPE>>

For example:
2010_0505_SMITH_JOHN_PhotologgerForm.PDF

Uploading Sample Information and Notifying Data Management

To upload all associated with a sample and/or observation event, go to the NOAA NRDA site at: www.noaanrda.org

On the left-hand navigation columns, click on "Data Entry/Data Exports" under the **Access/Post Data** heading. From here, users will notice a link to the Uploading Tool. Under the **Workgroup:** dropdown menu, choose "-All Sample Data/Chemistry" and click on the **Upload** control button in the upper right-hand corner. This will navigate the user to the actual page for file collection uploads.

Choose the Workgroup and Workplan related to your sample team (if you do not know this, contact your Technical Workgroup lead). From here you will be asked whether observational data was also collected during the sampling event. If you have observational data, you will be prompted to enter this information in a portion of the NOAA NRDA site dedicated to observation data (from there, users can also upload sample data). Otherwise, if a user does not have observational data, a series of data entry prompts will appear. This includes prompts to enter general information about the sampling event and places to upload specific files. Note that the NOAA NRDA site currently has a limit of 1 GB *per file.* If you have files that are larger than 1 GB, please split into multiple files, label appropriately, and enter in the additional files using the dropdown that the bottom of the Sample/Chemistry Data section. Here, users can specify the type of auxiliary document associated with the file collection.

Also, please do not scan documents at a resolution higher than 300 DPI. This will help keep file size down.

*******IMPORTANT*******

Once you have uploaded the file collection to NOAA NRDA, you must alert the data management staff. Please send an email to the Gmail account (dwhnrda@gmail.com) as notification. Specifically, please use the following subject heading: SAMPLE TO NOAA NRDA<<YYYY>>_<<MMDD>>_<<LAST NAME>>_<<FIRST_NAME>> For example: SAMPLE TO NOAA NRDA 2010_0505_SMITH_JOHN

Once again, thank you very much for following these procedures. Assistance from all sampling teams will improve efficiency and reduce our need to call you back for missing information.

Deepwater Horizon Oil Spill (DWHOS)

Water Column and Fish Technical Working Group

Summary of Historical Shelf and Offshore SEAMAP Fish and Plankton Data

April 2, 2011

The NMFS/NOAA SEAMAP program is a fishery-independent State/Federal/university cooperative data collection program that covers nearly all of the Gulf of Mexico. With over 25 years of data, this program is a significant resource for understanding the characteristics of the Gulf of Mexico biological community. The SEAMAP program includes numerous surveys that sample egg, larval, juvenile, and adult life stages of fish and invertebrates throughout the year, with surveys ranging from shore to 500 m depth (Table 1). Each survey typically covers a portion of the Gulf of Mexico (Figure 1 – 12). The SEAMAP program includes dedicated plankton surveys, shrimp/groundfish/pelagic trawl surveys, longline surveys, and trap/video surveys. The strength of the SEAMAP data set is its longevity; 2010 was the 29th year (GSFMC 2010a). Unfortunately, surveys that cover the offshore areas of the Gulf of Mexico are more limited in time-series and seasonal coverage (only the Spring Plankton Survey has sampled offshore areas since the 1980s).

Table 1. A summary of NMFS/NOAA SEAMAP surveys. Information from GSMFC (2010a-b), Henwood *et al.* (2010a-d), NMFS and GSFMC (2001), and Rester (2010).

Survey	Location	Gear	Sampling Period	Years
SEAMAP Spring Plankton Survey	• Offshore Texas to Florida beyond the 200 m depth contour. • Florida continental shelf in recent years. • Stations are located at approximately ½ degree intervals (~56 km).	• 61 cm bongo net with 0.335 mm mesh. • Single or double 2 m x 1 m neuston net with 0.950 mm mesh. • 1 m MOCNESS used in recent years only. • some CUFES[1] data in recent years.	April through early June	1982 – present
SEAMAP Fall Plankton Survey	• Continental shelf from Brownsville, Texas to Key West, Florida, generally within the 200 m depth contour. • Stations are located at approximately ½ degree intervals (~56 km).	• 61 cm bongo net with 0.335 mm mesh. • Single or double 2 m x 1 m neuston net with 0.950 mm mesh. • 1 m MOCNESS[2] used in recent years only. • some CUFES data in recent years.	Late August through mid-October	1986 – present
SEAMAP Winter Plankton Survey	• Continental shelf and slope from Brownsville, Texas to Key West, Florida. • Stations are located at approximately ½ degree intervals (~56 km).	• 61 cm bongo net with 0.335 mm mesh. • Single or double 2 m x 1 m neuston net with 0.950 mm mesh. • some CUFES data in recent years	January through March	1983, 1984, 1993, 1996, 2007 – present

[1] Continuous Underway Fish Egg Sampler/Thermosalinograph.
[2] Multiple Opening and Closing Net, with an Environmental Sensing System.

Survey	Location	Gear	Sampling Period	Years
SEAMAP Summer Shrimp/Groundfish and Plankton Survey	• Continental shelf from Brownsville, Texas to Mobile Bay, Alabama (~88°W). • Early in the time series, sampling extended almost to Key West, Florida. • Stations are stratified by depth and NMFS statistical shrimp zones.	• 40-ft or 20-ft otter trawl[3]. • Trawl tow duration is variable from 10 min to 55 min. • 61 cm bongo net with 0.335 mm mesh. • Single or double 2 m x 1 m neuston net with 0.950 mm mesh.	June and July	1982 – present (SEAMAP protocol adopted in 1987)
SEAMAP Fall Shrimp/Groundfish and Plankton Survey	• Continental shelf from Brownsville, Texas to Mobile Bay, Alabama (~88°W). • Early in the time series, sampling extended almost to Key West, Florida.	• 40-ft or 20-ft otter trawl[3]. • Trawl tow duration is variable from 10 min to 55 min. • 61 cm bongo net with 0.335 mm mesh. • Single or double 2 m x 1 m neuston net with 0.950 mm mesh.	late September to early December	Mid-1950s –1972: exploratory surveys, 1972: resource assessment survey, 1985 – present (SEAMAP protocols were adopted in 1987)
SEAMAP Winter Shrimp/Groundfish and Plankton Survey	Texas to Alabama	Similar protocols to other shrimp/groundfish and plankton surveys	January to February	2009 – present
SEAMAP Spring Shrimp/Groundfish and Plankton Survey		Similar protocols to other shrimp/groundfish and plankton surveys	March to April	2009 – present

[3] NMFS, Alabama, Mississippi, and Louisiana State stations are sampled with a 40-ft otter trawl. Texas State stations are sampled with a 20-ft otter trawl.

Survey	Location	Gear	Sampling Period	Years
Bottom Longline Survey	• Continental Shelf from Brownsville, Texas to Key West, Florida. • Depths from 9 m to 366 m. • Stations are stratified by depth and NMFS statistical shrimp zones.	• Each line is 1 nmi. long, 100 hooks per line, 12 ft. ganglions, #15/0 circle hooks, baited with Atlantic mackerel. • Soak time = 1 hour.	July to September	1995 – present
SEAMAP Inshore Longline Survey	Nearshore from Texas to Alabama.	Each line is 1 nmi. long	March to October	2008 – present
Alabama Vertical Longline Survey	• Coastal Alabama • Targets artificial reefs and other areas.	• Vertical longline reels, baited with Atlantic mackerel or squid. • Soak time = 5 min.	April to June	2010 – present
SEAMAP Reef Fish Survey	• Continental shelf from Texas to Key West, Florida. • Depths from 10 m to 150 m.	• Camera array, baited with squid, soak time = approximately 30 minutes. • Fish traps, baited with squid, soak time = approximately 1 hour.	May to August	1992 – 1997, 2001 – 2002, 2004 - present
Small Pelagics/Deepwater Trawl Survey	• Offshore from Brownsville, Texas to Sarasota, Florida. • Depths from 50 to 500 m.	• 90-ft high opening bottom trawl. • 30 minute tow duration (timed from when the trawl arrives at the bottom). • Tow speed is 3 to 3.5 knots.	October to November	2002 – present

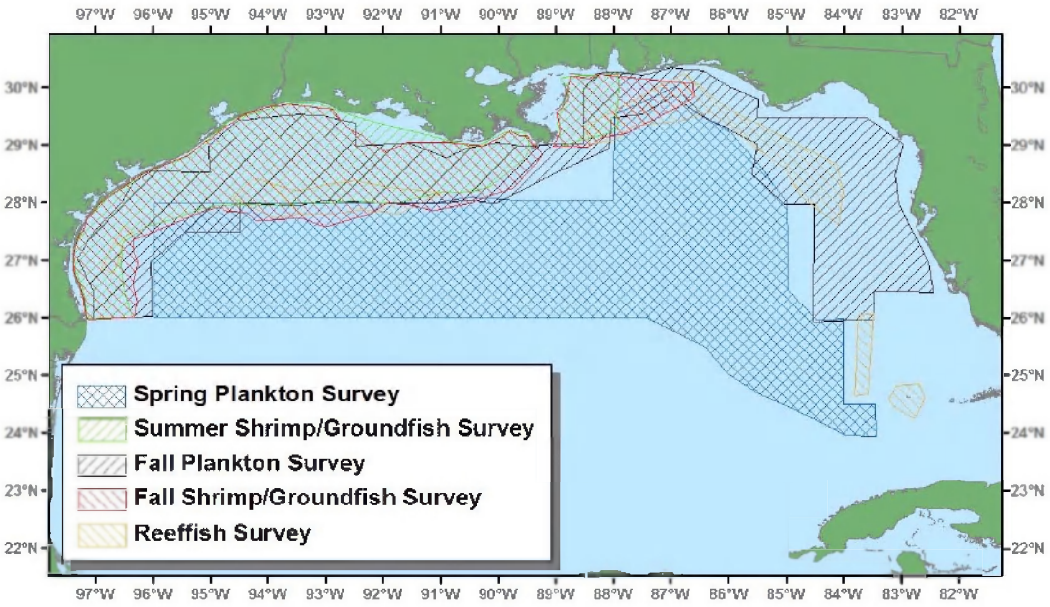


Figure 1. Spatial coverage of some SEAMAP surveys (Rester 2010).

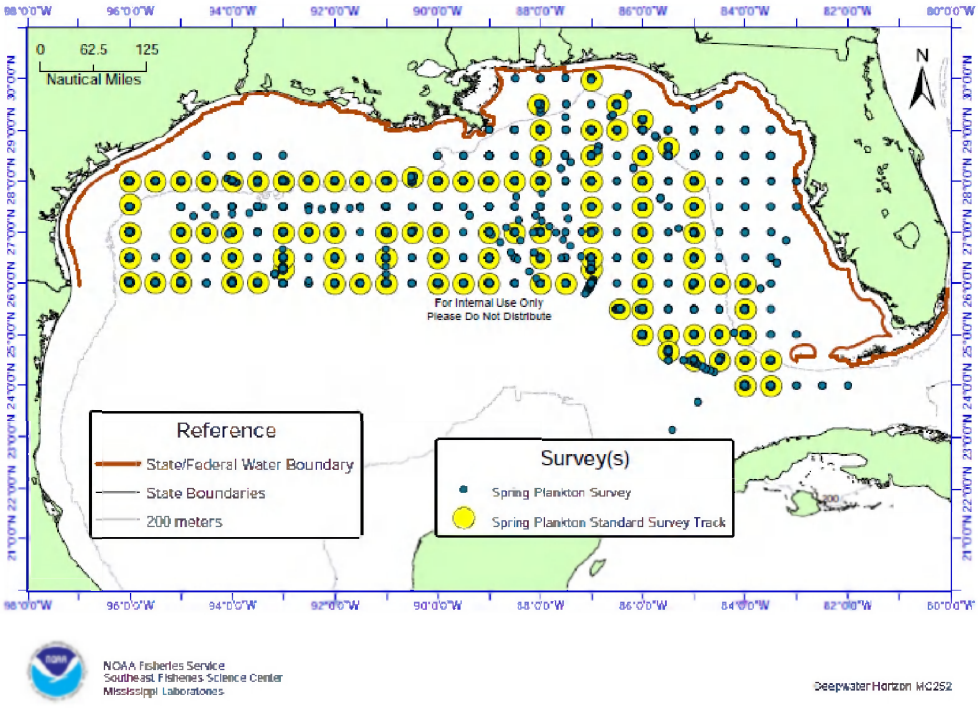


Figure 2. Locations of SEAMAP Spring Plankton Survey effort from 1982-2008.

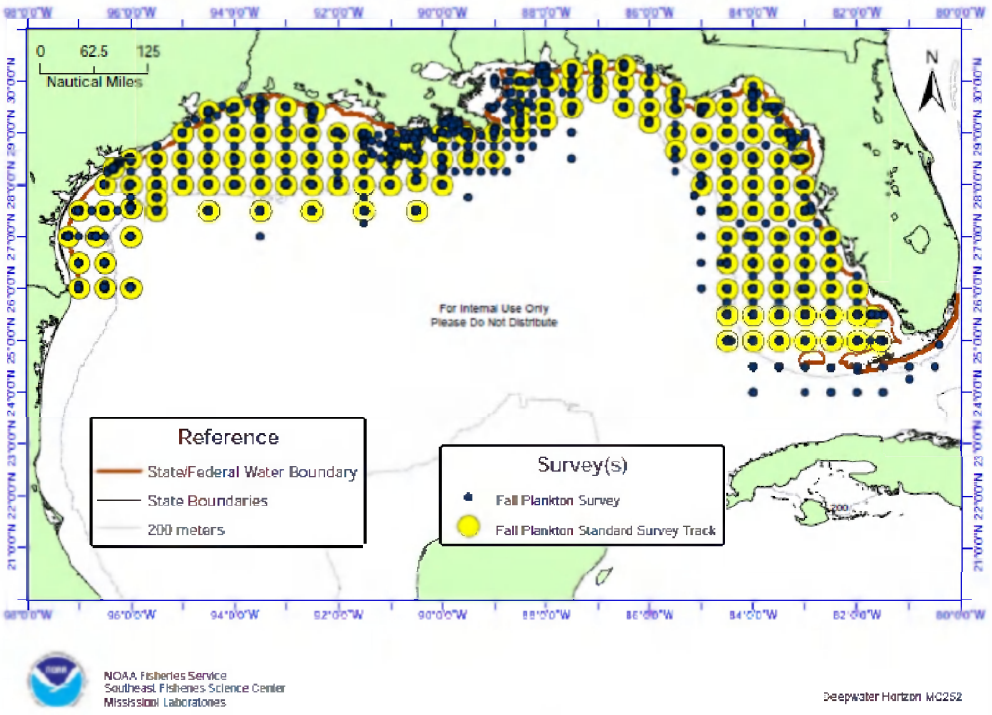


Figure 3. Locations of SEAMAP Fall Plankton Survey effort from 1986-2008.

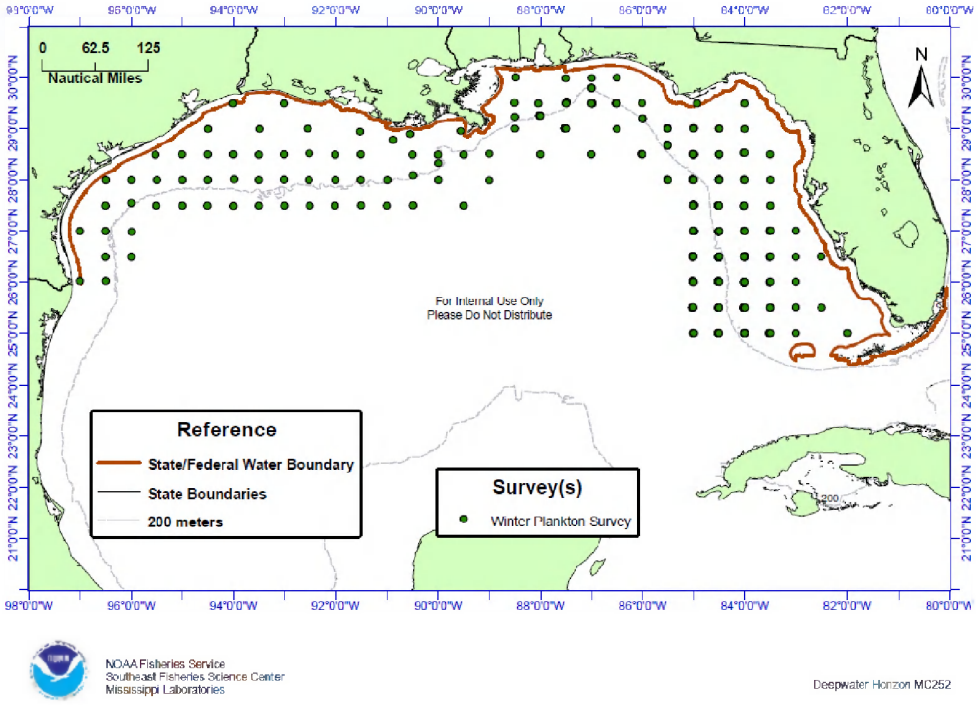


Figure 4. Locations of SEAMAP Winter Plankton Survey effort during 2007 and 2008.

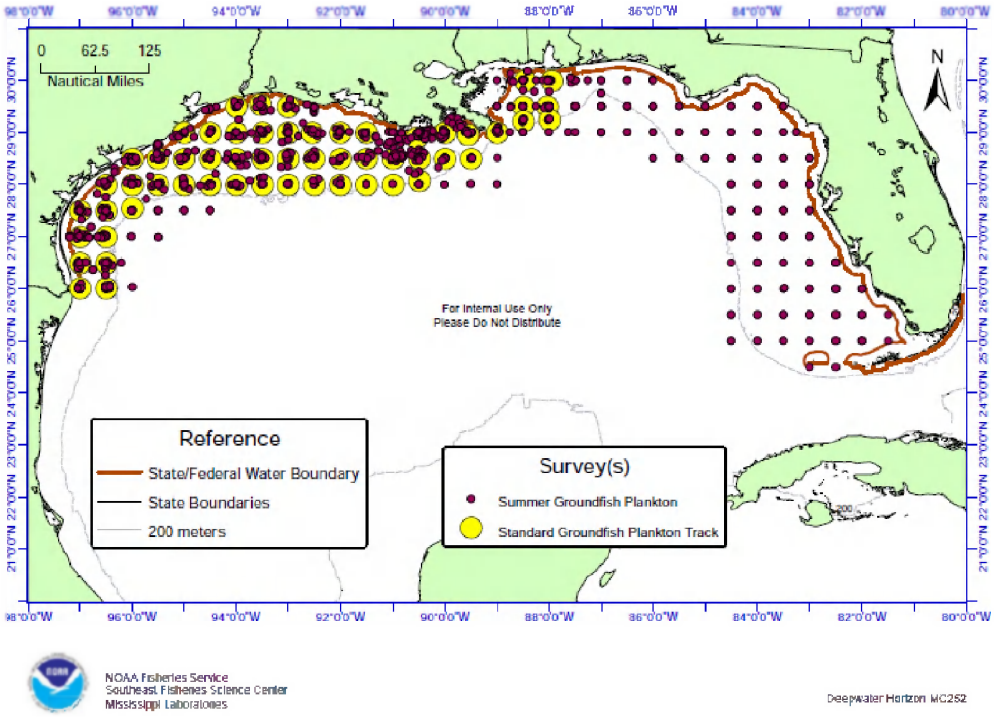


Figure 5. Locations of SEAMAP Summer Shrimp/Groundfish and Plankton Survey plankton sampling effort from 1982-2008.

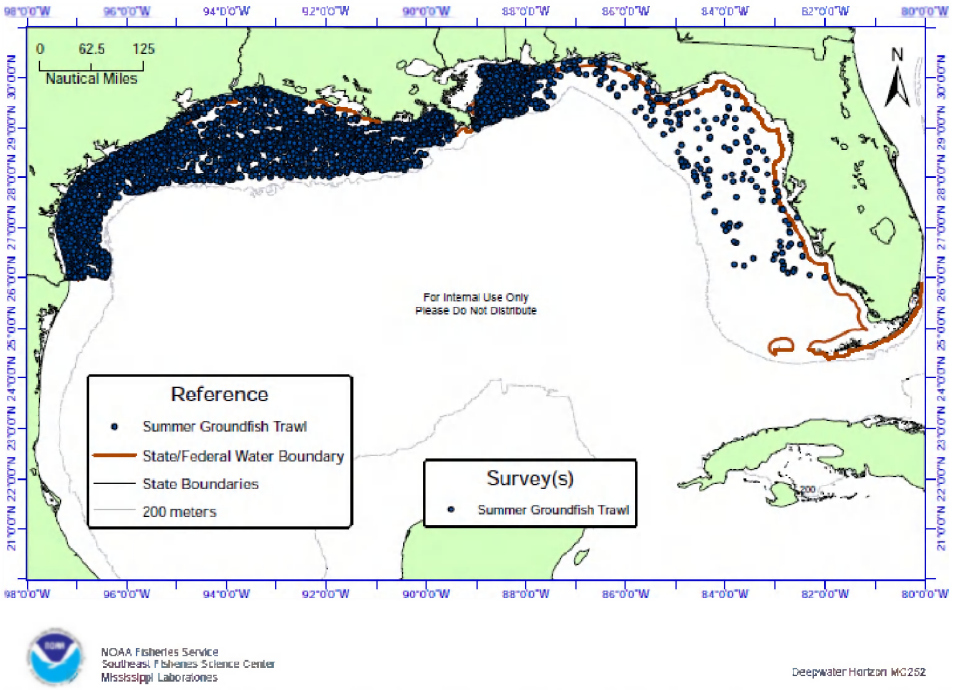


Figure 6. Locations of SEAMAP Summer Shrimp/Groundfish and Plankton Survey trawl effort from 1987-2009.

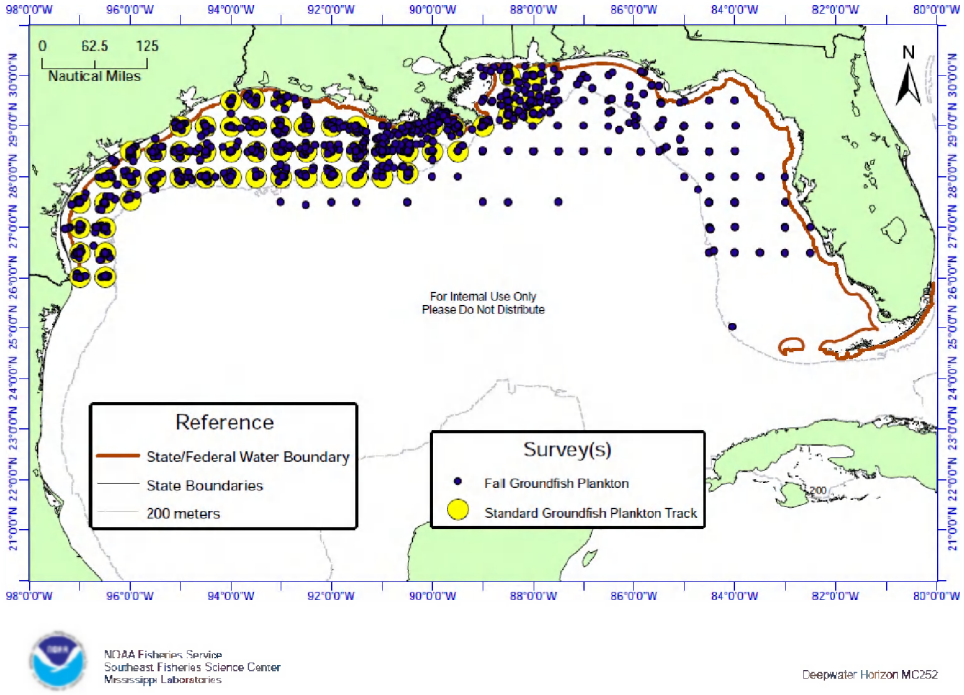


Figure 7. Locations of SEAMAP Fall Shrimp/Groundfish and Plankton Survey plankton sampling effort from 1986-2006.

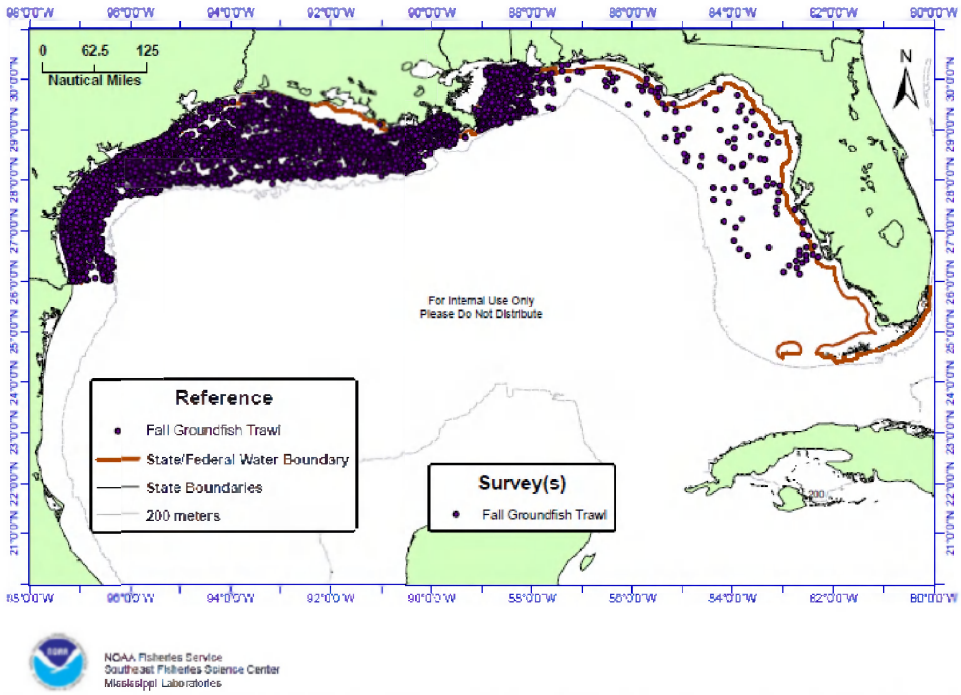


Figure 8. Locations of SEAMAP Fall Shrimp/Groundfish and Plankton Survey trawl effort from 1987-2009.

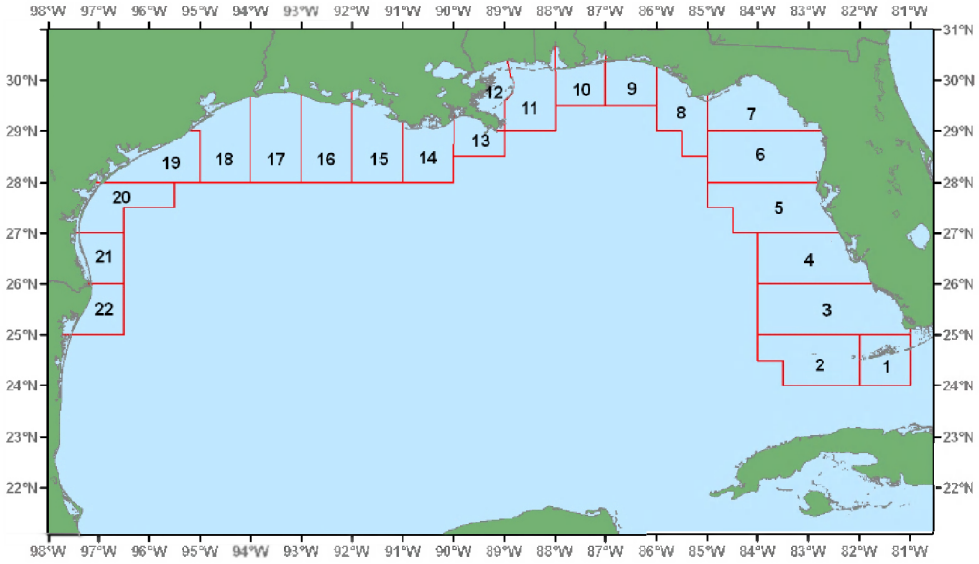


Figure 9: NMFS statistical shrimp zones in the Gulf of Mexico (Rester 2010).

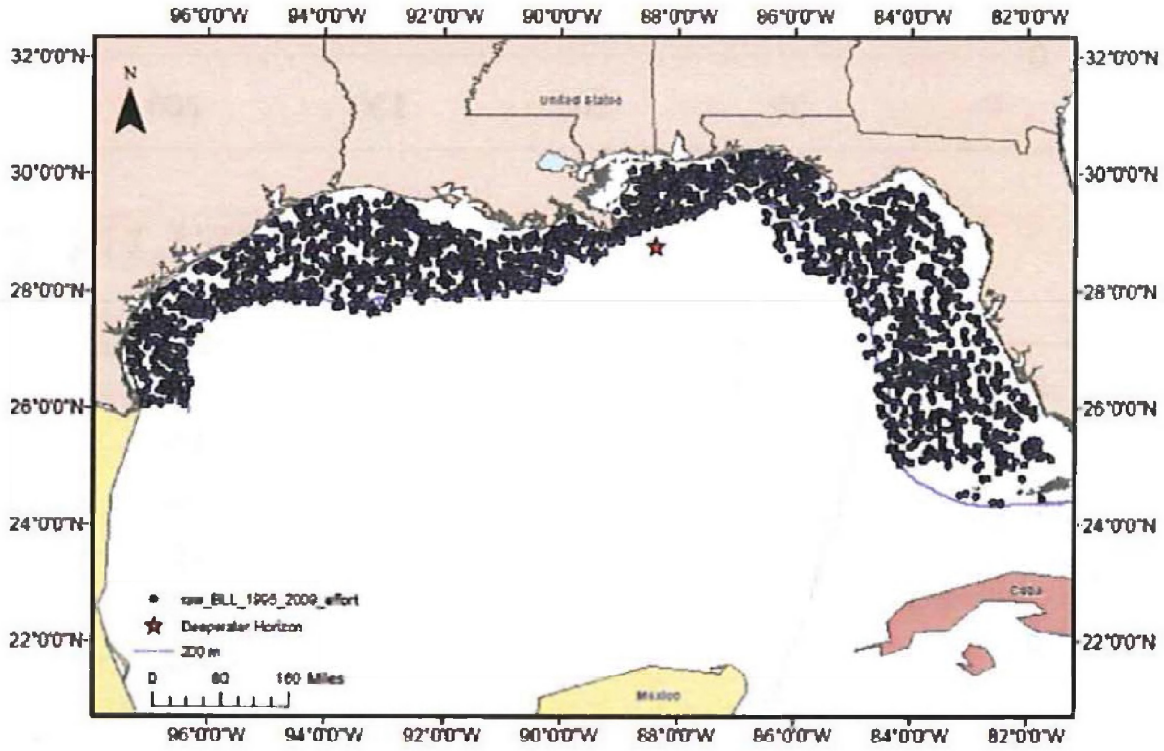


Figure 10. Bottom Longline Survey effort from 1995-2009.

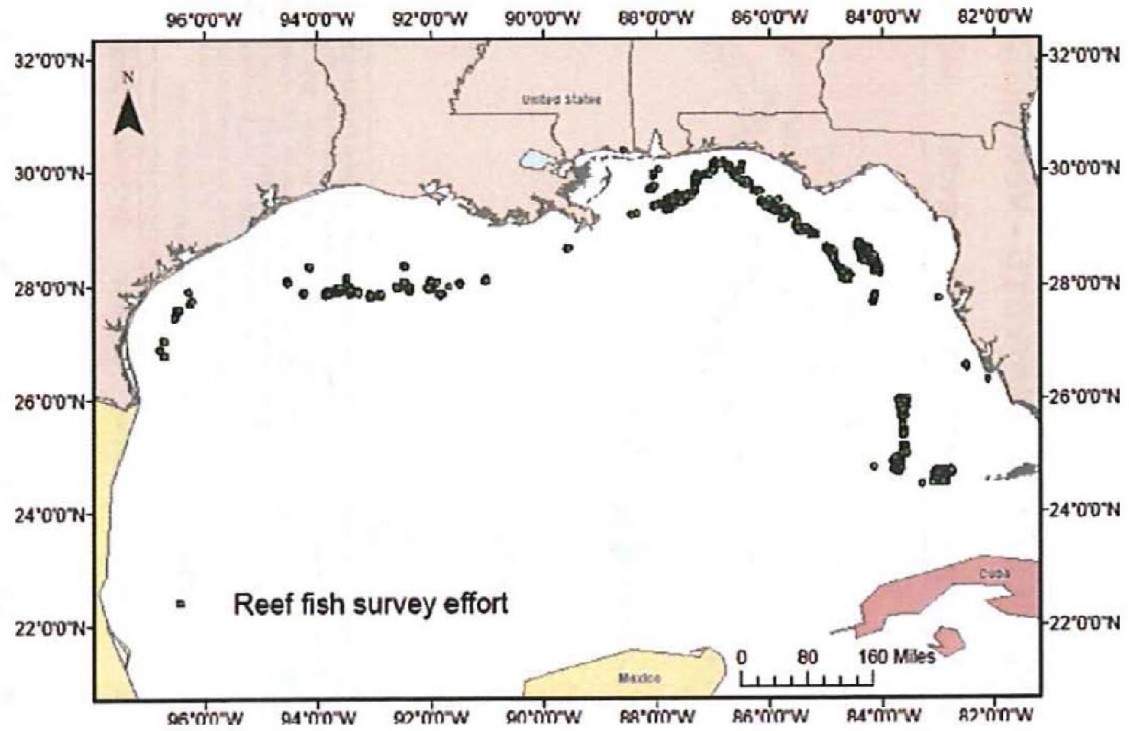


Figure 11. SEAMAP Reef Fish Survey effort 1992-2009.

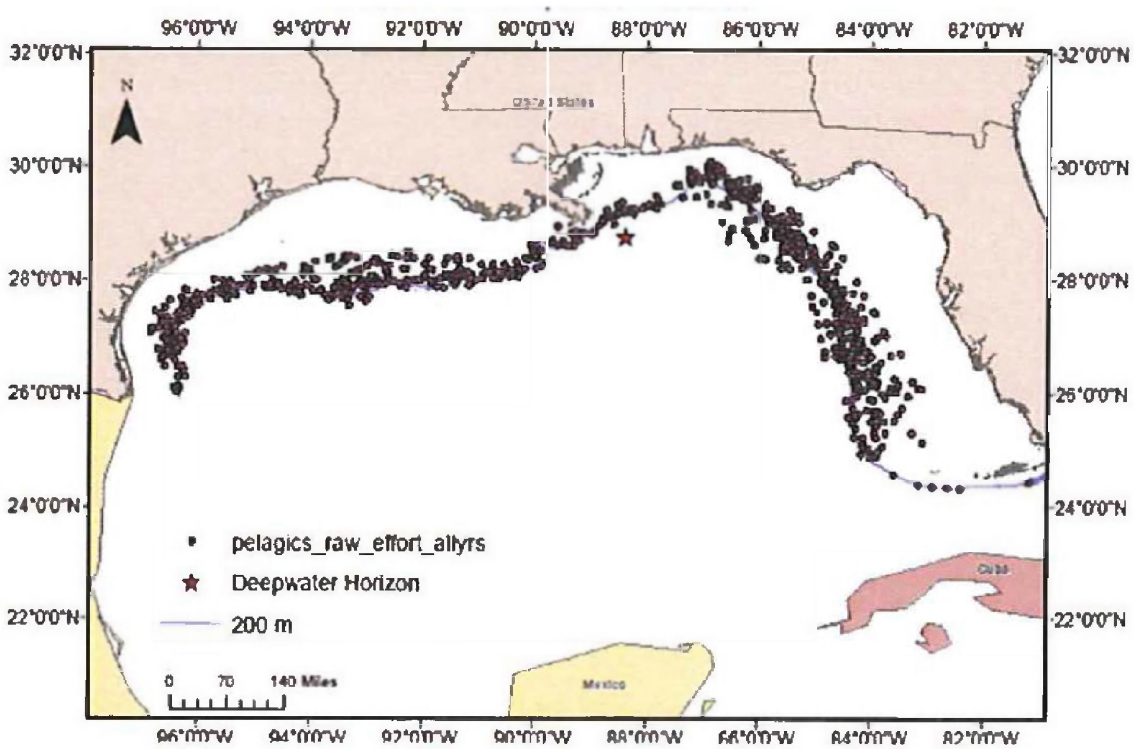


Figure 12. Small Pelagics/Deep Water Trawl Survey effort 2002-2004 and 2006-2009.

References

Gulf States Marine Fisheries Commission (GSMFC). 2010a. Annual Report of the Technical Coordinating Committee, Gulf States Marine Fisheries Commission, Southeast Area Monitoring and Assessment Program (SEAMAP) Subcommittee. October 1, 2009 to September 30, 2010. Number 187.

Gulf States Marine Fisheries Commission (GSMFC). 2010b. Annual Report of the Southeast Area Monitoring and Assessment Program (SEAMAP). October 1, 2008 to September 30, 2009. Number 177.

Henwood, T., P. Moreno, W. Ingram, and M. Grace. 2010a. Bottom Longline Surveys *in* For SEAMAP/Deepwater Horizon Meeting, St. Petersburg, Florida, 21-24 September, 2010. NOAA Fisheries Science Center, Mississippi Laboratories, Resource Surveys Branch.

Henwood, T., P. Moreno, W. Ingram, and G. Pellegrin. 2010b. Shrimp/Groundfish Surveys *in* For SEAMAP/Deepwater Horizon Meeting, St. Petersburg, Florida, 21-24 September, 2010. NOAA Fisheries Science Center, Mississippi Laboratories, Resource Surveys Branch.

Henwood, T., P. Moreno, W. Ingram, and C. Gledhill. 2010c. Reef Fish Surveys *in* For SEAMAP/Deepwater Horizon Meeting, St. Petersburg, Florida, 21-24 September, 2010. NOAA Fisheries Science Center, Mississippi Laboratories, Resource Surveys Branch.

Henwood, T., P. Moreno, W. Ingram, and G. Pellegrin. 2010d. Small Pelagics/Deep Water Trawl Surveys *in* For SEAMAP/Deepwater Horizon Meeting, St. Petersburg, Florida, 21-24 September, 2010. NOAA Fisheries Science Center, Mississippi Laboratories, Resource Surveys Branch.

National Marine Fisheries Service (NMFS) and Gulf States Marine Fisheries Commission (GSMFC). 2001. SEAMAP Field Operations Manual for Collection of Data. October 2001 (Revision No. 4).

Rester, J.K., *editor*. 2010. Environmental and biological atlas of the gulf of Mexico. Gulf States Marine Fisheries Commission (GSMFC). Number 179. June, 2010.

Deepwater Horizon Oil Spill (DWHOS)

NRDA Plankton Sampling Plans: 1-m^2 MOCNESS Deployment Protocol

April 15, 2011

Vertical distribution of plankton in the in the entire water column will be measured by sampling at depth discrete intervals at deep offshore stations using a 1-m^2 Multiple Opening and Closing Net and Environmental Sensing System (MOCNESS) (333 μm mesh). The MOCNESS is an instrumented net system that is capable of taking discrete samples over specific depth strata (Figure 1). The instrument package on the MOCNESS can record data on water column physical properties as well as chlorophyll fluorescence.

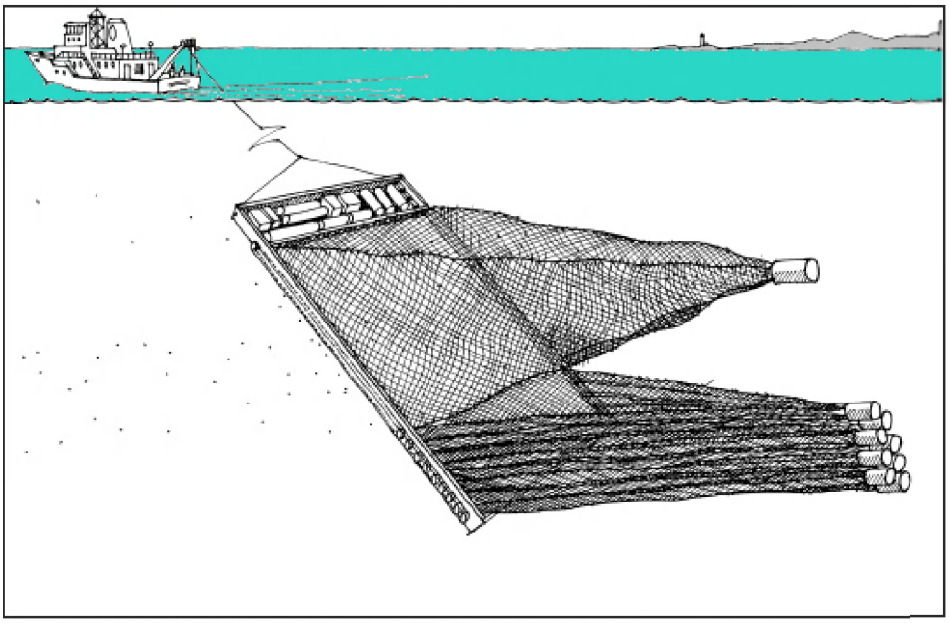


Figure 1. Schematic showing general MOCNESS deployment.

MOCNESS Deployment

When setting up for a MOCNESS tow on station, operational considerations of the vessel are paramount. On most vessels, the MOC should be towed into the seas, but the capabilities of individual vessels should also be considered, such as if the vessel has variable pitch propellers. The navigational chart should always be consulted when setting up for a tow on station. Additional hazard information available to the captain, operations leads, and chief scientist should also be reviewed. In general, it is preferable to tow from areas of shallower bathymetry to deeper areas when sea conditions allow. However, it is recognized that sea state and wave direction dictate the safe direction of towing of the MOC regardless of bathymetry. The decision regarding which way to tow the MOC will be the responsibility of the chief scientist, in discussion with the captain and operations leads.

While the MOC is deployed, data from the depth sounder on the vessel should be monitored over the tow path to ensure that the operators are aware of any subtle bathymetry changes that deviate from the navigational chart. The operator can always truncate the depth of a tow if the depth sounder shows bottom depths that are shallower than anticipated upon consultation of the navigational chart. It is recommended that operators not deploy the net to less than 100 m of the bottom in areas where the bottom depth is greater than 1000 m and allow a clearance of 10% of the water depth in water shallower than 1000 m. It is recognized that local conditions and operator experience will dictate the safe and effective depth of individual MOC tows. The overall scientific goal is to sample the greatest percentage of the water column possible without creating undue risk to the MOCNESS or vessel. Variations from the towing protocol given field conditions are expected and acceptable.

MOCNESS will be deployed to 1500 m (or the maximum safe depth in shallower locations) twice at each station (1 day tow, 1 night tow). For each deployment (day and night), the tow of 4-5 hours will be conducted centered in time around local noon and midnight. If this is not possible, the tow may still be completed so long as it does not begin until 2 hours after sunrise/sunset or end within 2 hours of sunrise/sunset. These are timed to best capture the differences in diel distribution patterns.

As time permits, up to two (1 day, 1 night) additional MOCNESS deployments to 160 m will also be conducted. These shallow deployments are secondary and shall not interfere with the primary objective of the deep MOCNESS deployments.

0-1,500 m 1-m^2 MOCNESS Tows

The MOCNESS will be towed obliquely through the water column from a maximum depth of 1500m using 333μm mesh nets. The first net (net 0) will be open all the way down to 1500m. Upon commencing the oblique tow back to the surface, the second net will be opened and cover the depth range from 1500m to 1200m. Additional nets will be opened and closed at depth intervals of 200m until the epipelagic zone lower limit (at 200m). The epipelagic zone will be split into two depth intervals 200-25m and 25-0m (Table 1). While the bottom depth at the different stations will vary, the maximal depth of 1500m is near bottom for most all the stations and using standard depth bins at all stations allows us to compare the data between stations. The depth bins are spaced to achieve the highest resolution possible in the deep water column with the limitation of nine nets. The upper two depth bins of 200-25m and 25-0m were chosen as they are the same depth strata sampled by nets in the SEAMAP program. The upper 25m net allows resolution of the community in the upper mixed layer, which would have been most exposed by re-entrained floating oil.

For 0-1500m sampling, the MOCNESS will be deployed twice at each station (1 day tow, 1 night tow). Sampling will occur 24-hours a day. At each station, a tow of 4-5 hours duration will take place during the day and a tow of 4-5 hours duration will take place at night. These will be timed to best capture the differences in diel distribution patterns, i.e., centered on local noon and midnight. Thus, samples will be obtained both in daylight and during the night.

Table 1. Depth bins for 0-1500m 1-m^2 MOCNESS tows.

Net Number	Depth Bin (m)
Net 0	0-1500
Net 1	1500-1200
Net 2	1200-1000
Net 3	1000-800
Net 4	800-600
Net 5	600-400
Net 6	400-200
Net 7	200-25
Net 8	25-0

Approximate tow time is expected to be 4 hours, plus 10-60 minutes per deployment of the gear. The vessel will tow the sampler between 1.5 and 2.5 knots (~62m/min). The target winch speed during haul back is 5 m/min. Target volume of water filtered varies by depth bin, as indicated in Table 2.

Table 2. Target volume, target winch speed, and estimated tow time for each depth bin sampled.

NET	TARGET DEPTH	TARGET VOL. m^3	TARGET WINCH SPEED (m/min)	ESTIMATED TOW TIME (min)
0	0-1500	NA	50*	30
1	1500-1200	3000	5	60
2	1200-1000	2000	5	40
3	1000-800	2000	5	40
4	800-600	2000	5	40
5	600-400	2000	5	40
6	400-200	2000	5	40
7	200-25	1500	5	35
8	25-0	500	2-3	10

*After MOC has been deployed and lowered to approximately 300 m and flight angle has stabilized.

0-160 m 1-m^2 MOCNESS Tows

The MOCNESS will be towed obliquely through the water column from a maximum depth of 160 m. The first net (net 0) will be open all the way down to 160 m (or from a safe distance off the sea floor). Upon commencing the oblique tow back to the surface, net 1 will be opened and cover the depth horizon indicated in Table 3. Additional nets will be opened and closed at 20-m depth intervals as indicated up to the surface (Table 3).

Approximate tow time is expected to be 1 hour, plus 10-60 minutes per deployment of the gear. The vessel will tow the sampler between 1.5 and 2.5 knots (~62m/min). The target winch speed during haul back is 2.5 m/min. The target volume filtered for each 20-m depth strata is $500m^3$. Target winch speeds and volume of water filtered by depth bin are in Table 4.

Table 3. Depth bins for 0-160m 1-m^2 MOCNESS tows.

Net Number	Depth Bin (m)
Net 0	0-160
Net 1	160-140
Net 2	140-120
Net 3	120-100
Net 4	100-80
Net 5	80-60
Net 6	60-40
Net 7	40-20
Net 8	20-0

Table 4. Target volume, target winch speed, and estimated tow time for each depth bin sampled for 0-160 m 1-m^2 MOCNESS tows.

NET	TARGET DEPTH	TARGET VOL. m^3	TARGET WINCH SPEED (m/min)	ESTIMATED TOW TIME (min)
0	0-160	NA	10	16
1	160-140	500	2-3	8
2	140-120	500	2-3	8
3	120-100	500	2-3	8
4	100-80	500	2-3	8
5	80-60	500	2-3	8
6	60-40	500	2-3	8
7	40-20	500	2-3	8
8	20-0	500	2-3	8

Operations Planning and Execution

Pre-survey planning and during-survey operations are outlined below. These protocols are taken into consideration by the chief scientist, operations lead, and boat captain when planning and executing a MOCNESS tow.

Pre-survey Planning

- Stations where water depths are 250m or more greater than the deepest sampling depth are deemed to not pose a risk and are cleared from this protocol except for the appropriate standoffs from platforms.
- Pre-plan MOCNESS transects
    a. Review available bathymetry data and hazards maps
    b. Sea state and wave direction will dictate the tow path direction. When possible, the transect should be oriented from areas of shallower bathymetry to areas of deeper bathymetry
    c. Transects within the vicinity of platforms will maintain at least a 3-nmi buffer zone from the platform based on knowledge of the subsea structure from previous experience or obtained by direct communications with the platform. [Platforms in deep water can have anchor spreads exceeding 1000ft from the platform. Vessels

towing deep tow systems have limited maneuverability. If power to the vessel is lost and wind/currents are pushing the vessel towards the platform at 1.5 knots, the vessel has less than 2 hours to regain power and retrieve the tow package.]

d. Normal transect profiles without hazards shall maintain a minimum vertical clearance above the bottom of 10% of the water depth up to 100 m.
e. Transects that traverse hazards (pipelines, wrecks, cables) will maintain a vertical clearance of at least 250 m from the hazard while over the hazard.
f. Prior to survey the Chief Scientist or appointed watch lead will consult with the Lead Operations and the vessel captains on potential transect hazards and decide on best transect route.

During Tow Operations

- Deck crew will be briefed on potential transect hazards prior to system deployment
- Verify fathometer depth is close to bathymetry data when charts provide the appropriate data. The real-time depth data should always be relied upon more than the chart for actual bottom depth while the chart provides larger scale context and tow planning.
- During the tow, the fathometer shall be continuously monitored for hazards or radical changes in depth.
- The depth sensor on the MOC system should be monitored as it is deployed to ensure that approximated depths are being displayed and recorded.
- MOCNESS depth sensor will be continuously monitored and compared to the fathometer depth to maintain the MOCNESS system a safe distance off the seafloor
- Ships Officers on Watch (OOWs) shall continuously monitor radar and sea conditions for vessels traffic, vessel activities, and uncharted or unknown structures
- Winch operators will be in continuous communications with both navigators and OOWs
- Back deck operators will continuously monitor cable angles from the a-frame
- As required by USCG Rules of the Road, the survey vessel shall display a limited maneuverability symbol to inform other vessels that they are towing an instrument.

Deepwater Horizon Oil Spill (DWHOS)

NRDA Plankton Sampling Plans:
1-m MOCNESS Sample Handling and Preservation Protocol

March 28, 2011

Overall Sample Handling Procedure

Upon recovery of the MOCNESS, each net will be washed down with salt water and the contents of the cod ends rinsed into buckets with icepacks. The samples from **nets 1-9** will then be preserved in the following manner: collect each sample on a sieve, rinse into a collection jar with sea water, and preserve in 10% buffered formalin (37% formaldehyde solution). The sample from **net 0** will be preserved in the following manner: collect each sample on a sieve, rinse into a collection jar with 70% ethanol (95% ethanol stock diluted with seawater to 70%), and fill the jar completely with the 70% ethanol solution. In the event that the sample contains any large organisms that will not fit in the sample jar or requires a more concentrated preservative, the large organisms will be rinsed with sea water (back into the sample to ensure none of the smaller organisms are removed), and then preserved in a separate container with the appropriate mixture of buffered formalin. If the total biomass takes up more than 50% of the jar the sample should be moved to a larger jar or split into two jars – maintaining the preservation percentages.

For samples where the volumes of gelatinous zooplankton exceed the capacity to save, the whole sample will be rinsed with sea water to separate the larger jellies and ensure the smaller organisms are not caught. The smaller size fraction will be preserved as described above and the volume and species composition of sieved jellies will be recorded using a calibrated large volume measuring device and photography. These techniques do not constitute a quantitative measure, but can be used qualitatively.

All samples will be held under NOAA NRDA chain of custody. All samples will be sent to Malinda Sutor's laboratory at Louisiana State University (or her designee).

Chemicals

Buffered Formalin: Buffered formalin is created by adding sodium borate (Borax can also be used) to the stock 37% Formaldehyde Solution. Sodium borate should be added in small quantities until the formalin cannot hold any more and the borate begins to precipitate out of the solution. When this is reached, the buffered formalin should be tested with a pH strip to ensure it at neutral pH (8). The buffered formalin is then ready to add to samples.

70% Ethanol: 70% ethanol is created by diluting the 95% non-denatured ethanol stock with sea water. This solution is then ready to be used to rinse the sample from the sieves into the sample jar, and then fill the rest of the way to avoid evaporation.

Storage: Store unopened formalin and ethanol inside Flammable Liquid Storage Cabinet outside of wet lab or in the fume hood.

Laboratory Standard Operating Procedures – 1-m MOCNESS

1. Wash down the net with sea water from the highest possible point, rinsing any specimens into the secured cod end
2. Empty the cod end of the net into the respectively numbered buckets with icepack in the bottom. Rinse the cod end and collar of the net thoroughly into the bucket.
    - Repeat for the remaining 9 nets/cod ends
3. For each sample, strain the sample on a sieve to remove excess water
4. Rinse the sample into a sample jar
    - This should be done with sea water for nets 1-9 and 70% ethanol for net 0
    - If 50% or more of the sample (once water is added) is biomass the sample needs to be split into 2 separate jars
5. When sample is ready for preservation, add the internal label
6. Preserve the samples
    - Nets 1-9 should be preserved with 10% buffered formalin
    - Net 0 should be preserved with 70% ethanol
7. Dry the outside of the sample jars and apply the external labels
    - Once labeled, wrap the entire jar in clear tape to ensure labels do not come off

Sample Preservation

NET 0 (70% ETHANOL)

- Strain all seawater from sample using 70% ethanol in sea water solution
- Fill jar with 70% ethanol and cap with correct lid
- Place preserved sample jar into fume hood or staging area and note on Ethanol data sheet awaiting second preservation
- 24 hours following initial preservation, strain sample and refill with fresh ethanol
- Move waste ethanol into waste container

NETS 1-9 (BUFFERED FORMALIN)

- Ensure the sample jar has adequate space (i.e. 1/3 volume) for formalin
- Measure 10 parts formalin per volume of sample container with graduated cylinder and pour into sample jar
    - 500 ml sample jar = 50 ml formalin
    - 1000 mL sample jar = 100ml formalin
- Fill any remaining samples jar head space with seawater and secure jar lid

Safety Measures

- Wear proper PPE (i.e. hard hat, steel toe boots, and PFD)
- Wear gloves, goggles when handling hazardous chemicals
- Work in a well-ventilated area (i.e. outside or in fume hood) with proper lighting
- Watch for slips, trip and falls when entering/exiting science lab and while working on back deck
- Make sure channels of communication are properly used and everybody is following same procedures of collecting, analyzing and preserving samples
- If you are unsure, as your watch lead or chief scientist

Water Column Injury Ephemeral Data Collections:
Deepwater Horizon Oil Spill (DWHOS)

Plan for Adaptive Water Column NOAA-NRDA Sampling (PAWNNS)
Chelsea Aquatracka Fluorometer
August 11, 2010

Instrumentation:

The Chelsea UV Aquatracka is a submersible fluorometer which is specifically designed to monitor hydrocarbon concentrations. With and excitation wavelength of 239 nm and an emission wavelength of 360 nm, it is well suited to measuring dissolved polycyclic aromatic hydrocarbons (PAHs). The Aquatracka has a detection range of 0.01 to 10 ug/L. The Aquatracka can be used in profiling mode and is compatible with most Seabird CTDs. The instrument is rated to 6000 m, and so may be deployed to full ocean depth in the Gulf of Mexico.

Sampling Methodology:

The Aquatracka will be deployed as a part of the sensor package on a Seabird 19 Plus CTD. The CTD will be lowered on a conducting wire from a winch, to depths up to 2000 m (and possibly somewhat deeper to 2500m). The Aquatracka The data processing can be done using standard Seabird software and can provide real-time fluorescence data.

Deepwater Horizon Oil Spill (DWHOS)

Water Column and Fish Technical Working Group
Fisheries Acoustic Data Collection:
Standard Operating Procedures for Deep Water Locations

April 15, 2010

Summary
Acoustic data collected with scientific sonar systems (e.g. Simrad EK60 Fisheries echosounders, Simrad ME70 Multibeam echosounder) can be used to assess biological biomass information. In addition to being collected by the NOAA data manager under Chain-of-Custody procedures (see main plan), a copy of acoustic data collected will under NOAA NRDA Chain-of-Custody procedures be passed onto Dr. Kevin Boswell, of Louisiana State University who oversees the fisheries acoustic data collection for NOAA NRDA. The data will be stored in a secure facility.

Approach
The primary objective is to couple multi-frequency hydroacoustic survey techniques with concurrently collected MOCNESS sampling efforts to acquire resolution on the composition and relative abundance of meso- and bathypelagic plankton species. For this initial effort, the Scientific Sonar System Simrad EK60 split beam echosounder will be used to quantify the acoustic scattering throughout the water column. Data will be collected at 18, 38, and 200 kHz frequencies; the 18 kHz is used to quantify water column targets to the deepest station depths, the 38 kHz is used to quantify different targets higher in the water column than that detected by the 18, and the 200 kHz may prove to be useful for detecting targets at shallow depths and provide insight into the level of biomass distributed in the upper water column during descent (deployment) and ascent (retrieval) of the MOCNESS.

During station surveys, geo-referenced acoustic data, in addition to net location, based on mensuration sensors, will be viewed in real-time on the acquisition computer and simultaneously stored on external memory devices. During acquisition, station-specific logs will be populated to include pertinent information on the station location, summary of acoustic observations, relevant net behavior and catch, as well as any other observational data of importance. Following contemporary approaches to post-processing acoustic data, we will initially scrutinize the data on board using a widely-adopted standardized software, Echoview (v4.9). Logged and stored acoustic data may be further processed in the laboratory to derive abundance and biomass metrics using multi-frequency analysis tools available in Echoview or other analyses. (Potential analysis approaches will be developed later and are not included in this work plan.).

Standard Operating Procedures
Below are the standard operating procedures for the collection and cataloging of acoustic data collected in deep water for the NRDA.
Questions should be directed at Dr. Kevin Boswell (LSU, kboswe1@lsu.edu).

SIMRAD ER60 OPERATIONAL MANUAL- NRDA COLLECTION SETTINGS

Shallow and Deep Water Collection

Purpose: This manual is intended to serve as a resource for instituting a system-wide configuration protocol for collecting acoustic data on vessels associated with the Trustee-led cruises of the Gulf of Mexico. These instructions are intended to allow you to set up the system and verify that all the important settings have been set to the correct values to ensure standardized collection parameters.

DOCUMENT CONTENTS:

Document Revision History

Modified by Kevin Boswell (LSU) for shallow water collection (4/9/2011)
Modified by Kevin Boswell (LSU) with comments from Alex De Robertis (1/21/2011)
Modified by Alex De Robertis for PICES/GUNTER for deepwater gulf of Mexico settings 6/16/10

THIS DOCUMENT HAS BEEN MODIFIED FROM DOCUMENTS USED ABOARD OSCAR DYSON BY THE ALASKA FISHERIES SCIENCE CENTER. THE CONFIGURATION DISCUSSED HERE IS FOR DEEP WATER AT THE DEEPWATER HORIZON SPILL SITE.

THE PING RATES AND DATA COLLECTION LIMITS USED HERE ARE NOT APPROPRIATE FOR SHALLOW WATER.

SIMRAD ER60 Software Settings- Shallow Water (> 1000 m)

Note- These settings are to be used when data are collected on the continental shelf and slope waters in the Gulf of Mexico, and are useful when conducting acoustic operations while transiting across the shelf and waters to 1000m. These settings were developed with the expectation that data will be collected while underway to NRDA sampling stations. Care should be taken to observe water depths while underway, as the change quickly when transiting across the shelf break, typical water depths of 300m-1000m. ***Thus, settings will need to be changed to the deep water settings when water depth exceeds 1000m.***

IMPORTANT: Minimize the use of other echosounders. It is important to secure all other sounder systems while collecting the EK60 data. These instruments cause a lot of interference, and data collected with these instruments on are not very useful. The interference is visible as vertical marks on the echograms one ping wide. In addition, other acoustic devices the ADCP should be synchronized if it is used with the EK60.

Note:
If you need to stop the sounder for any reason, you can just click the stop button on the ER60 toolbar.

At the end of the data collection period, please turn everything off and unplug the deck units. We do this to **avoid inadvertently pinging when out of the water.**

The Basic steps are summarized below:

1) Ensure that the transducer pole is in the water and transducers are submerged– **you will damage the transducers if they are out of the water.**
2) Power deck units/PC
3) Start er60 application, input settings
4) Start pinging – verify data collection

Step 1

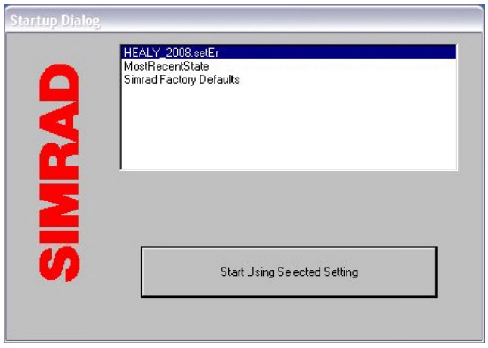
Check that the transducers are immersed in water (i.e. the transducer pole is submerged). If you are unsure, do not ping until you find out.

Step 2

Power the EK60 Deck units
Power up the deck units (GPT's)- There is no on/off switch. You just plug it in. You should see the power lights illuminate and some activity on the network interface (TX/RXLEDs).

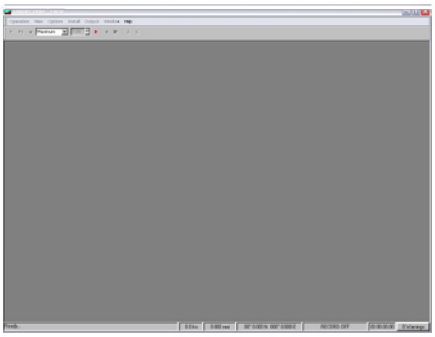
<u>Go to Acoustics Lab Primary EK60 Computer:</u>

Start the ER 60 program by clicking on the ER60 icon.
If prompted for a login, click 'OK' without entering a password
Select most recent state and then input parameters as described below



Step 3.

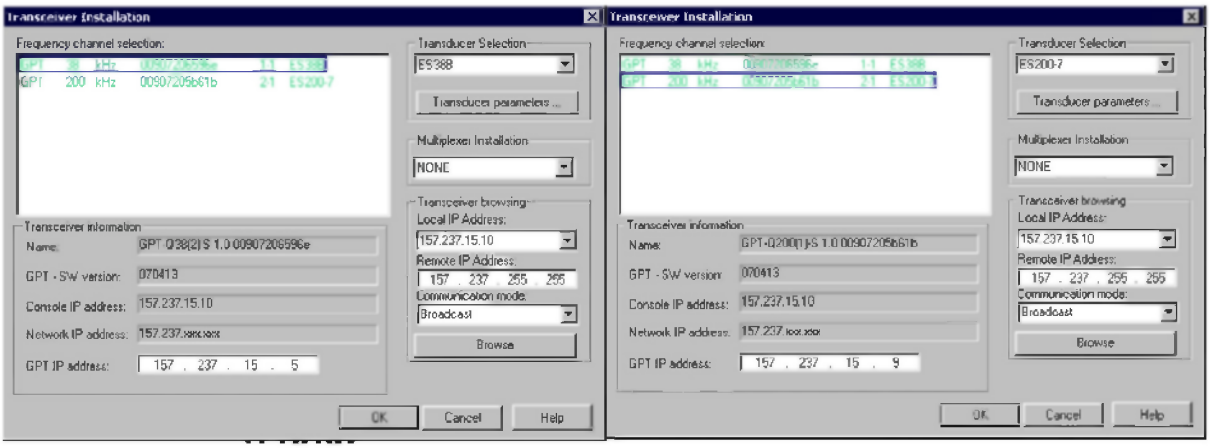
The following window will load



Under **Install > Transceiver**, check:

- All GPTs are green vs. red

This tells you that the PC sees the GPT's on the network.



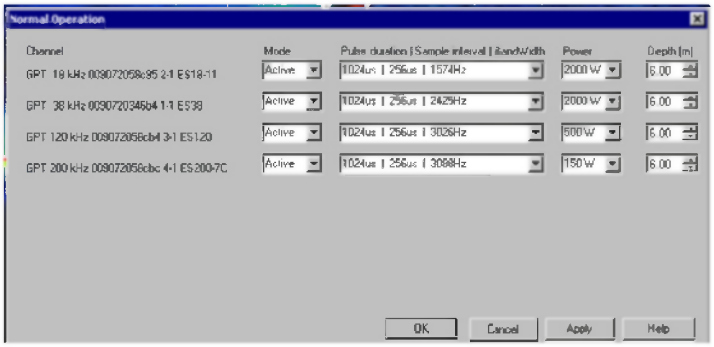
If the GPT's are red, check that they are

1) Powered
2) That the local IP address is the same as the network that the GPT is on (the DYSON PC has 2 network cards and sometimes the default card is the not the configured for GPT network).
3) If this does not, work with the ET's to make sure you can see the GPT's on the network- in our experience problems are typically issues with networking.

Click cancel if no changes are made

Under **Operation > Normal**, check:

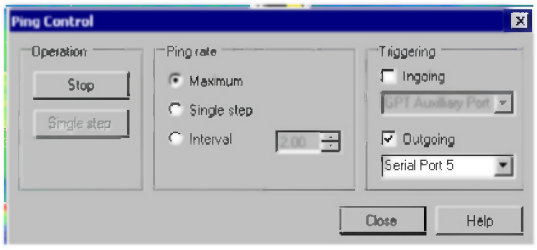
- Mode = Active
- Pulse duration/Sample interval/BandWidth – match power in figure below
- Select **1024** us pulse length for all frequencies
- Power= Match figure below (18/38kHz= 2000W; 200kHz-120W).
- Depth (m) of transducers (enter transducer depths relative to water surface- **this will vary for each vessel**)



Click cancel if no changes are made

Under **Operation > Ping Control**, check:

- Ping rate = **Maximum** and press close after updating.

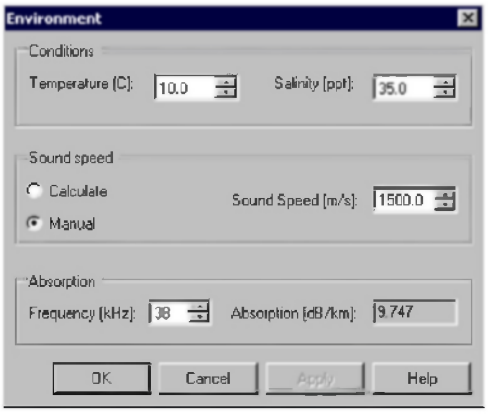


The Interval and rate should appear on the main software window too, and be set to **Maximum**.

Under **Install > Environment**, check:

- Set values that represent environmental conditions
- Temperature
- Salinity
- Sound Speed
  - **Manual**
  - **Set Sound Speed (m/s) to 1500 m/s**
  - **Temperature to 10.0 C- 20.0C**
  - **Salinity to 35.0 ppt**

  These parameters can be changed in post-processing but useful to be conservative during the collection.



Click cancel if no changes are made

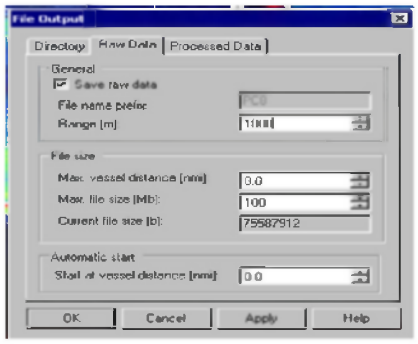
Step 4.

To collect the RAW data

Under **Output > File Output**:

>Directory Tab- will identify file directory path where files are saved

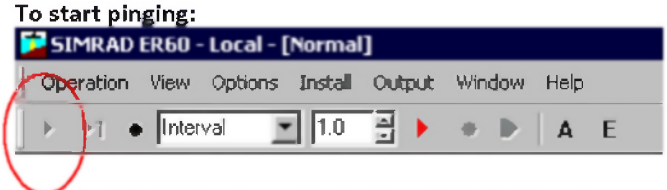
>Raw Data Tab- will identify file directory path where files are saved



- Check – Save raw data box
- File name prefix- should correspond to NRDA approved convention (e.g. NS8, Nick Skansi cruise 8; PC8, Pisces cruise 8)
- Range- **1000 m**, set this to correspond to water depth, but use caution as depths change quickly. When on shelf can be set to 100m, when on slope can be set to 250, 500, 750 or 1000m. **Be conservative, is better to have more depth than less. The data files will only record to depth entered in this field, regardless of what is shown on the echogram!! Safest to leave at 1000 m if unsure.**
- Max. vessel distance (nmi): set to **5.0 nmi**
- Max. file size (MB): set this to **100 MB**

>Processed Data Tab- No changes necessary

To start pinging:



Click the black triangle on the toolbar (it looks like a tape recorder control) to start pinging.

Bottom Detection Dialog- **Right click depth view on echogram display**

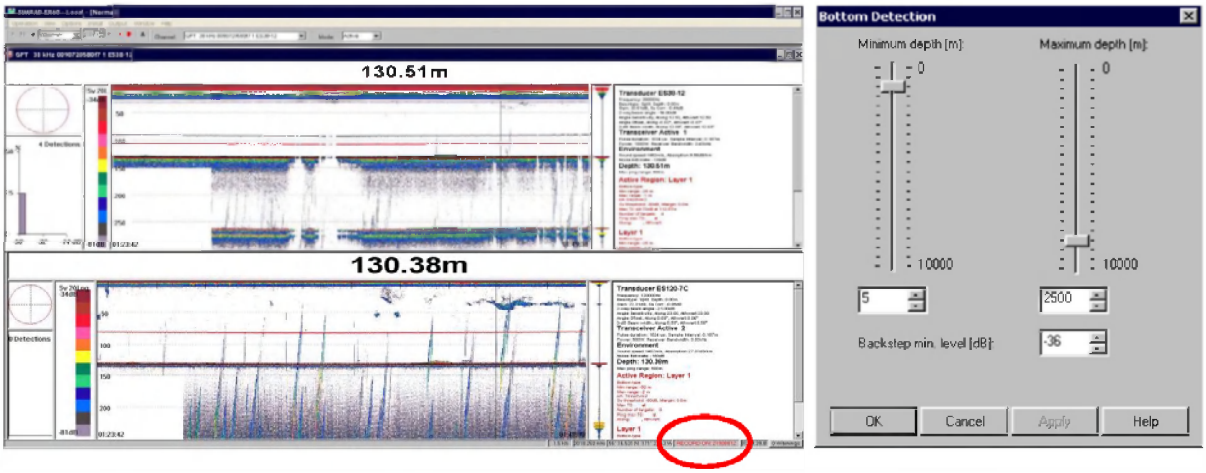
Right click on the top bar where the bottom depth is shown.

For 18 and 38 kHz transducers

Set min. distance to **5 m**, max distance to **1000m**, Bottom backstep min level = **-36 dB**. As described above, can vary this depth depending on water depths, best to be conservative.

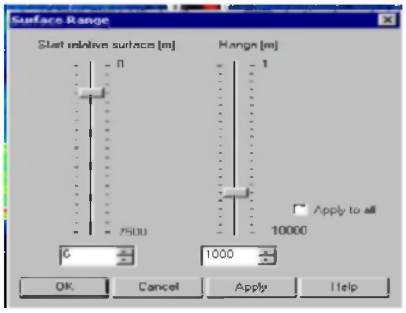
For higher frequencies (e.g. 200 kHz)- not really necessary in the deep water system.

Set min. distance to **5 m**, max distance to **300 m**, Bottom backstep min level = **-36 dB**



Echogram Range Dialog- **Right click on echogram display**

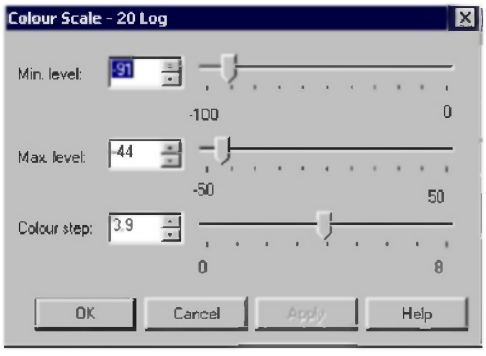
This will change the maximum depth that is displayed on the echogram. This needs to be changed for each frequency displayed. When transiting in shallow waters, this range can be modified as needed to maintain an appropriate window. For example, if water depth is 150m, the range could be set to 200m to ensure full water column coverage and accommodate fluctuations in water depth. **** The depth shown in this box does not affect the data that are recorded and saved in the datafiles** (see **Output > File Output > Raw Data** section above).



Color Scale dialog- **Right click color scale on echogram display**

This can be changed for each frequency displayed. Note- this will not change the data that are recorded, it simply changes the scale of data observed while recording.

Set min. level to **-90 dB**



SIMRAD ER60 Software Settings- Deep Water (> 1000 m)

Note- These settings are to be used when data are collected off the continental shelf in the Gulf of Mexico, and are useful when conducting acoustic operations between 1000-3000m. These settings were developed with the expectation that data will be collected at NRDA sampling stations which are generally range between 1800-2800m in water depth. For depths shallower than 1000m, see the Shallow Water Collection above.

IMPORTANT: Minimize the use of other echosounders. It is important to secure all other sounder systems while collecting the EK60 data. These instruments cause a lot of interference, and data collected with these instruments on are not very useful. The interference is visible as vertical marks on the echograms one ping wide. In addition, other acoustic devices the ADCP should be synchronized if it is used with the EK60.

Note:
If you need to stop the sounder for any reason, you can just click the stop button on the ER60 toolbar.

At the end of the data collection period, please turn everything off and unplug the deck units. We do this to **avoid inadvertently pinging when out of the water.**

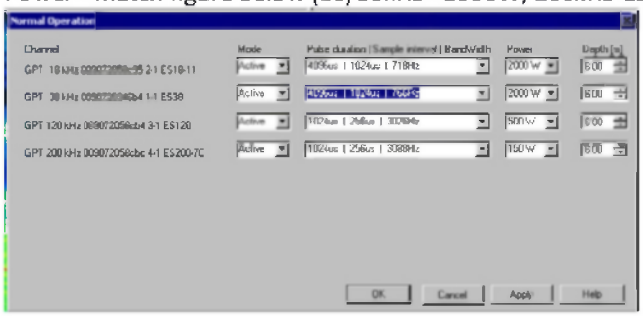
The Basic steps are summarized below:

1) Ensure that the transducer pole is in the water and transducers are submerged– **you will damage the transducers if they are out of the water.**
2) Power deck units/PC
3) Start er60 application, input settings
4) Start pinging – verify data collection

See Shallow Water collection for configuring Steps 1- 3 (pgs 2-3)

Under **Operation > Normal**, check:

- Mode = Active
- Pulse duration/Sample interval/BandWidth – match power in figure below, use **4096** us pulse length for 12/18/38 kHz, **1024** us for frequencies > 38 kHz
- Power= Match figure below (18/38kHz= 2000W; 200kHz-120W).

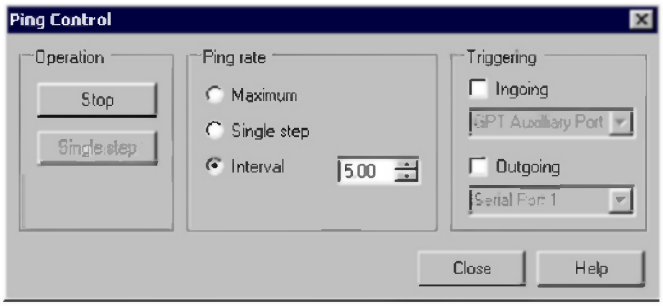


- Depth (m) of transducers (enter transducer depths relative to water surface)

Click cancel if no changes are made

Under **Operation > Ping Control**, check:

- Ping rate = Interval
- Interval = Desired ping interval. **(use 5 sec for 18 and 38 kHz in Deep Water)**. This will be represented by entering 5 in the interval field as this refers to the number of seconds per ping.



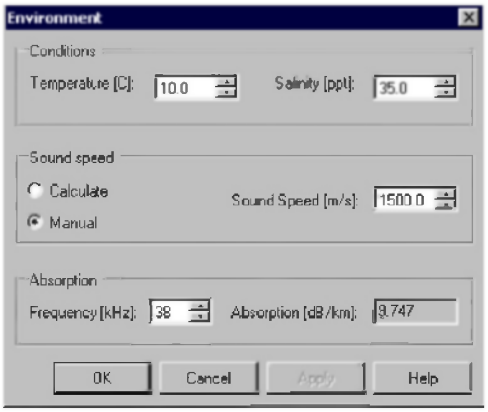
Close after updating.

The Interval and rate should appear on the main software window too, and be set to **5.0**.

Under **Install > Environment**, check:

- Settings appropriate for deep-water areas around the wellhead
- Temperature
- Salinity
- Sound Speed
  - Manual
  - **Set Sound Speed (m/s) to 1500 m/s**
  - **Temperature to 10.0 C- 20.0C**
  - **Salinity to 35.0 ppt**

  These parameters can be changed in post-processing but useful to be conservative during the collection.



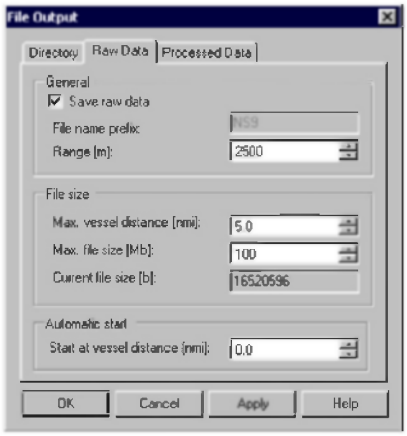
Click cancel if no changes are made

Step 4.

To collect the RAW data

Under **Output > File Output**:

>Directory Tab- will identify file directory path where files are saved

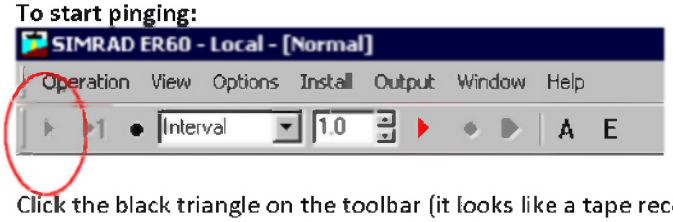


>Raw Data Tab- will identify file directory path where files are saved

- Check – Save raw data box
- File name prefix- should correspond to NRDA approved convention (e.g. NS8; Nick Skansi cruise 8)
- Range- **2500 m**, set this as universal depth to collect data. In the event the water column is deeper, you can modify this accordingly (e.g., 3000m).
- Max. vessel distance (nmi): set to **5.0 nmi**
- Max. file size (MB): set this to **100 MB**

>Processed Data Tab- No changes necessary

To start pinging:



Click the black triangle on the toolbar (it looks like a tape recorder control) to start pinging.

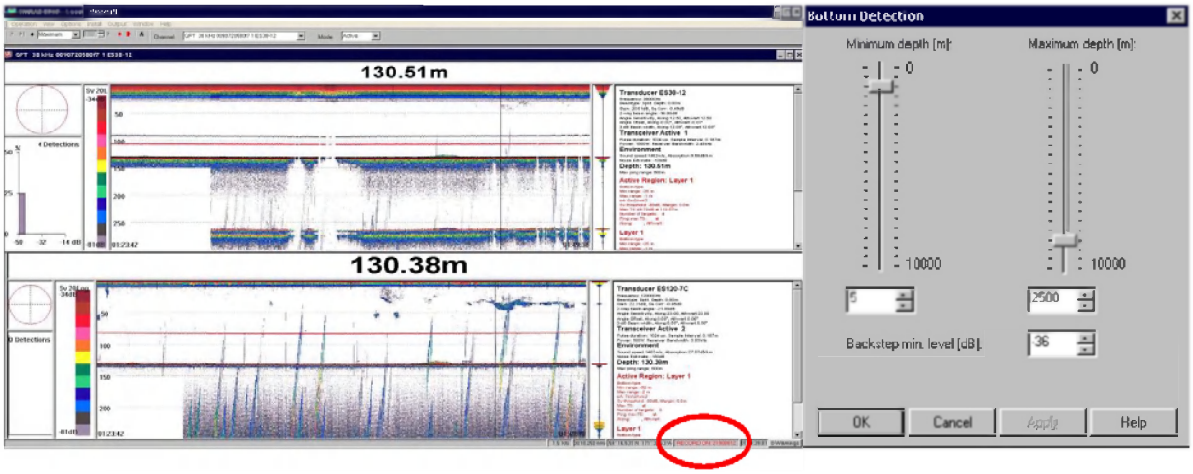
Bottom Detection Dialog- **Right click depth view on echogram display**

This will change the maximum depth that is displayed on the echogram. This needs to be changed for each frequency displayed.

Right click on the top bar where the bottom depth is shown.

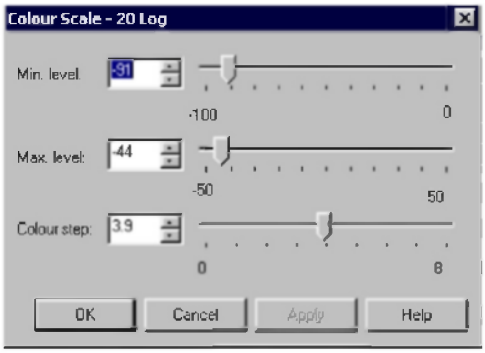
For 18 and 38 kHz transducers
Set min. distance to **5 m**, max distance to **2500m**, Bottom backstep min level = **-36 dB**

For higher frequencies (e.g. 200 kHz)- not really necessary in the deep water system.
Set min. distance to **5 m**, max distance to **300 m**, Bottom backstep min level = **-36 dB**



Color Scale dialog- **Right click color scale on echogram display**

This can be changed for each frequency displayed. Note- this will not change the data that are recorded, it simply changes the scale of data observed while recording.
Set min. level to **-90 dB**



IMPORTANT

You can tell if the echosounder is pinging by looking at the depth which will change if it gets a good bottom lock, and the echogram will advance as new pings come in. Further the GPS should be updating (see bottom right of screen).

Also, check that the 'record on' text in the lower right (circled below) is red, this means that you are recording data. **See red circle in above figure.**

Periodically verify that the two points listed above are correct, and that there are no other unsynchronized acoustic instruments pinging.

To turn off the sounder.
Click Operation>exit and exit the ER60 program.
Turn off the power strip to the deck units and then unplug it. The deck units do not have power switches and it is fine to unplug them.

Operational Process

Following proper setup of the ER60 system as described above, it is now time to initiate the collection protocol during operations (e.g., CTD sampling, MOCNESS tows, mid-water trawls, etc.) that may be conducted simultaneously with acoustic data collection.

As stated above, it is imperative to ensure that the transducers are fully submerged before operation!

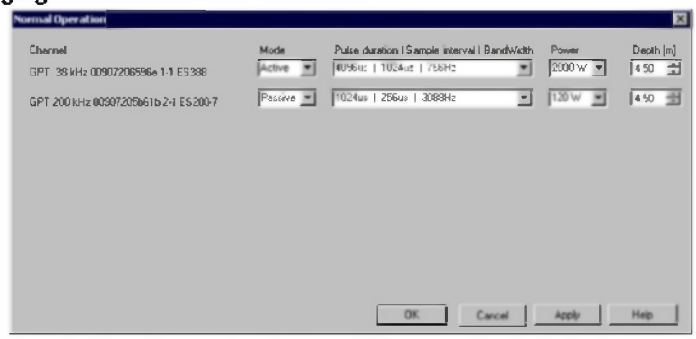
Once the EK60 system is running, it will be necessary to record datafiles in concert with specific sampling objectives as they correspond to primary objectives of the cruise, while recognizing that the focus of cruises may vary. Therefore, to make efficient and comprehensive use of the acoustic data collected, it is recommended that the EK60s be used whenever possible and be configured as described above.

It is requested that individual data files be collected during each operation (e.g., each CTD cast, MOCNESS tow, VPR deployment, etc.) where the operator will record data to the appropriate directory (as described above). Further, when possible, it is requested that acoustic data be recorded when transiting across the continental shelf break/slope to record change in scattering layers as you transit the dynamic shelf break/slope region.

Datasheets have been designed and will be provided to record relevant environmental and cruise-specific data as they pertain to the configuration, collection, processing and ultimately interpretation of recorded acoustic data.

General order of operations

1. **Submerge transducers**
2. **Turn on and configure ER60 software**
3. **Ensure system is functioning properly**
4. **Collect data in passive mode by changing Mode from Active to Passive**
   Record passive data at speed at which the operation will be conducted (e.g. MOCNESS tow at 2kts, therefore passive recording should occur at 2kts; CTD while stationary or drifting).
   Record for 5 min at each speed corresponding to each operation to be conducted at that site.



5. **Change Mode back to Active and initiate pinging. Ensure to change all frequencies installed.**
6. **Record acoustic data for duration of operation.**
7. **Turn off system and raise transducer pole following completion of operation at station.**

More details can be found on passive recording and can be very important when the primary objective is to collect acoustic data. If that is the case, please read the Noise Measurement at Sea section in the Simrad ER60 manual. Also- please contact Kevin Boswell (LSU; kboswe1@lsu.edu) for further instruction.

Calibration Notes

DO IT- IT IS CRITICAL!!

It is imperative that you calibrate the echosounder system routinely and do so for the parameters that the system has been configured for. Thus, the Simrad ER60 manual provides a complete description of the method to properly calibrate your scientific echosounder and can be found in the Calibration Section. Kevin Boswell will be arranging for each system to be calibrated at least within each season, if not more frequently as time allows. It is requested that you confer with Kevin Boswell (LSU; kboswe1@lsu.edu) in order to proceed with system calibration. In the event that personnel have sufficient experience and are able to follow the recommended procedures in the Simrad ER60 Manual, it is requested that those calibration files be sent to Dr. Boswell for evaluation and incorporation into post-processing procedures.

Contact Information:

If you have any trouble or questions, contact

Kevin Boswell
Kboswe1@lsu.edu (225-578-9390)

DEEP TOW SURVEY OPERATIONAL GUIDELINES

Revisions

			Authorizations				
Date	Rev	Changes					
2/7/11	0	Draft for comments	ER				
2/8/11	0	Draft for comments	LP				
2/26/11	1	Second draft for comments	LP				
3/01/11	1	Second draft for comments PRINT	LP				
4/11/11	2	Edits to procedures	LP				
4/1411	1	Edits to procedures	LP	RM			
4/16/11		Finalized language as agreed by parties					

Deep Tow Guidelines
For
NRDA 1-m and 10-m MOCNESS2011 Plankton Sampling Cruises
In support of
Deepwater Horizon Oil Spill (DWHOS)
Water Column Technical Working Group

CONTENTS

1 Introduction

In support of Deep Tow Operations for the NRDA 2011 Plankton Sampling Cruise Project the following protocols will be used as guidelines for using 1-meter² and 10-meter² Multiple Opening and Closing Net and Environmental Sensing Systems (MOCNESS). This document provides guidelines for the safe execution of the survey operations by identifying, at a minimum, the hazards and controls required to achieve the objective. This document is an addendum to CSA's Health, Safety and Environment manual.

2 Scope

The project plan calls for deploying 1-meter² and 10-meter² MOCNESS systems at 46 pre-planned station locations. Two vessels will be utilized, one will tow the 1-meter² MOCNESS and a second vessel will tow the 10-meter² MOCNESS. The MOCNESS will be deployed twice at each station (1 day tow/1 night tow). Sampling will be conducted on a 24-hour basis. The vessels will tow the MOCNESS systems between 1.5 and 3 knots. The MOCNESS is towed in an oblique profile thru the water column, from surface to bottom and back to the surface. The system is lowered to the bottom at a steady rate, once near bottom the system is retrieved and nets are opened and closed at various depths until the system is near surface at which point the system is recovered.

3 Systems Description

3.1 MOCNESS

The MOCNESS is a computer-controlled net system, with an integrated in-situ electronics package to measure environmental variables, which enables collection of plankton samples from specific depths in the water column (Figure 1).

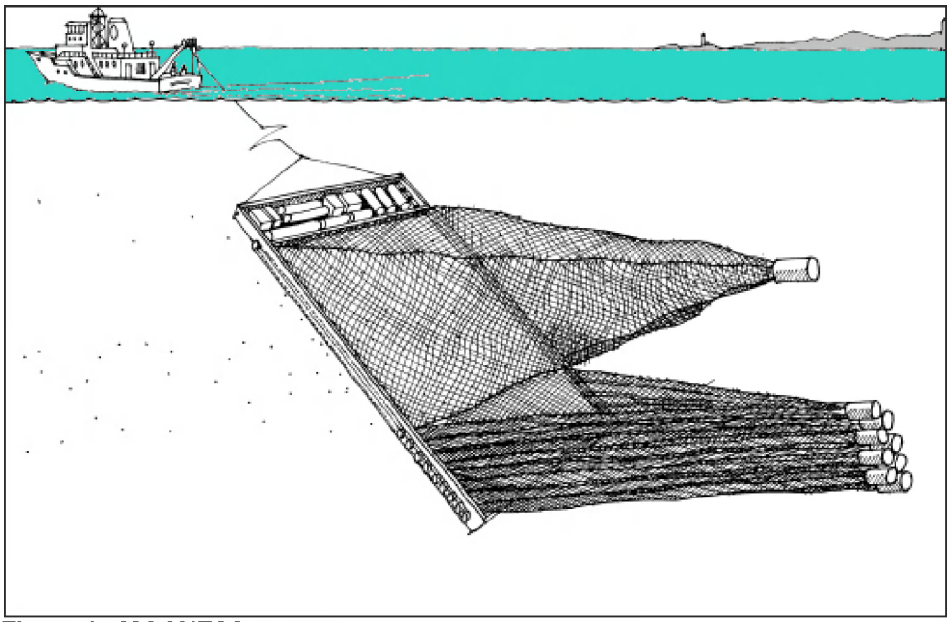


Figure 1. MOCNESS system

3.2 Navigation/Data Acquisition

The navigation/data acquisition system, used on both vessels for this project, consists of two main components, a Trimble DGPS positioning system and Hypack, a data acquisition system. The Trimble system provides real-time accurate position of the vessel. Hypack provides a means of displaying the station location and the vessel path on a standard computer monitor. Navigation monitors are setup in the survey control van and at the forward and aft control stations on the vessels bridge.

3.3 Bathymetry

A Simrad EK60 bathymetric split beam dual transducer system will be used to collect water depth, bottom features, and water column data. In these water depths and with the side pole constraints the max survey speed for EK60 data acquisition is 5 knots. Calibrating the EK60 for water sound velocity is critical to assure the accuracy of the system and confidence in the water depth to avoid contact with the bottom or man made structures.

3.4 Handling Systems

Considerable emphasis was placed on the design, fabrication, and implementation of the handling systems required to safely deploy and retrieve the 1-meter² and 10-meter² MOCNESS systems. Two major concerns were addressed in the design of the A-frames, tow cables, tow winches, and MOCNESS frame handling systems: Personnel safety and functionality.

4 Operations Overview

Prior to deploying the MOCNESS a station list is created. The vessel departs and steams to the first station. Once on station a drift check is conducted to ascertain surface current speed and direction. Personnel and systems are made ready and the vessel starts along a best course into the seas and current. The MOCNESS system is deployed and towed in a standard oblique pattern, down and up, and retrieved to the vessel deck. Samples are processed and the MOCNESS is made ready for the next tow.
The tow length and time can vary depending on the weather conditions, water column currents, and bottom depth at a station. Approximate tow duration for each station ranges from 4 to 6 hrs and up to +- 12 NM. Transects are roughly straight lines conducted primarily from shallower to deeper waters unless wind conditions or surface currents dictate a different course. Since the towing system is comprised of fine mesh nets it has increased drag and currents throughout the water column can significantly affect its towing attitude and position behind the vessel, such as pushing the towed system considerably away from the vessel path centreline, either to the starboard or the port side depending on vessel line steering relative to currents.

5 Hazard Analysis Overview

The following hazards have been identified for deep tow operations and mitigating controls implemented prior to commencement of the work. Where appropriate, procedures will be modified on board the vessel to reflect the actual working arrangements and the local environment. The deployment of the MOCNESS systems presents many potential safety hazards. In order to address potential HSE concerns associated with this project, the project operations has been divided into discreet task related elements. Typical HSE hazards are identified for each element. However it is stressed that these hazards are subject to review during the survey with mandatory infield administrative controls.

- Study area/Station location hazards
- Vessel orientation
- HSE awareness

- Deck operations
- Deployment and Recovery operations
- Towing and sampling operations

6 Hazard Identification & Risk Assessment Procedures

The purposes of the hazard identification and risk assessment are to identify the degree of risk associated with the survey and determine the preventative or protective controls required. The CSA Vessel Manager or a person appointed by the Vessel Manager will implement arrangements to ensure that all survey activities are subject to a formal assessment of risk prior to the commencement of individual operations.

6.1 Hazard Identification

Hazard identification involves the review of all survey methods related to the project. Significant hazards, and who might be harmed by these hazards, will be identified and a pre-survey site visit will be carried out prior to the scheduled sampling date by the Site Representative to identify the hazards on site. The site visit, however, will not be performed if it would delay the scheduled sampling.

6.2 Risk Assessment

The evaluation of risks involves:

- Deciding whether existing precautions are adequate or more should be implemented to eliminate the hazards identified.
- Evaluating whether all items written in law or in generally accepted trade standards have been adhered to.
- Selecting those hazards that can be reasonably foreseen, assess their risk levels and the methods of control.

All risks will be assessed and recorded in a Hazard Identification & Risk Assessment Form. A copy of this form will be sent to the HSE Manager for Assessment review, as well as to the Chief Scientist. The Vessel Manager will review the assessments periodically. If circumstances change to such an extent that the original assessment is rendered invalid, a new assessment will be carried out.

6.3 Job Hazard Analysis (JHA)

Where critical tasks are not controlled by procedures, a Job Hazard Analysis (JHA) will be conducted on board the vessel. The analysis will be developed by all personnel involved in the particular task in hand, documented and added to the HSE Plan. A JHA form shall be completed for all new operations.

A summary of hazards and critical operational activities, with the proposed mitigating controls, is detailed below:

Activity	Hazard	Control
Adverse Weather	Deck awash, vessel control	If risks are deemed unacceptable by the HSE Manager, in consultation with the Chief Scientist, for

		safety of personnel, suspend operations until weather favourable
Winch operations	Moving drum, managing tow cable	Operated by certified winch operators only
A-frame operations	Moving parts, hydraulic hoses	Operated by certified winch operators
MOCNESS deployment/recovery	Large heavy frame, unstable in high seas	CSA deploy/recover
MOCNESS deep tow survey	Contacting bottom or impacting structures	Identify and map all natural and man-made obstacles
Side Pole deployment/recovery	Heavy pole, wire cables	CSA deploy/recover
Cables Management	Entanglement	CSA managed

7 Risk Mediation

The following are risk mediation protocols which will be conducted prior to each field survey:

7.1 Pre-Survey Planning

- Review client (trustee) requirements
- Conduct hazard planning
- Compile existing data for survey areas
- Plot survey lines against existing bathymetry to determine geo-morphological hazards.
- Plot survey lines against existing man-made structures to determine structural hazards
- Chart and route analysis;
- Review published charts for the survey area
- Identify platforms, wreck sites, and subsurface assets
- Establish buffer zones around known structures

A set of navigation files containing data related to subsea assets and surface obstructions have been created for the project survey stations. These files are imported into the CSA navigation software package, Hypack, and are displayed during survey operations as background files, with the vessel track overlaid. These files were created to be used in order to improve risk assessment and tow design at each station before deploying the MOCNESS systems.

7.2 Pre-deployment

Create general bathy background files for areas to be surveyed. It is recommended that at least two transects be completed using the EK60 only to get a "picture" of the bottom along the intended tow path prior to deploying the MOCNESS. This will be performed at least 24-hours before a scheduled station so as not to delay the scheduled sampling. Any additional acoustic bottom detection data that can be collected on both sides of the intended tow transect, independently of the method chosen, would increase the level of confidence and safety when conducting low altitude tows.

- Adverse Weather plan communicated between survey operations and vessel
- Vessel emergency procedures communicated to survey personnel
- Review of JHA's and existing accident/hazard reports conducted
- Known marine traffic hazards identified and communicated

- Importance of hazard reporting communicated
  Individual responsibilities communicated
  Review risk assessment maps to identify subsea geological and man-made hazards

7.3 Deployment operations

- Do not deploy in an un-safe sea state (based on consideration of both wave period and height)
- Assure deployment team understands responsibilities
- Deployment area identified to all survey personnel and vessel crew
- Plan tow profile so that near bottom tows are in an areas which are clear of bottom features and structures
- Survey track design with estimative calculation of start and end points for the tow
- Check all lifting equipment
- Check the cables and wires for wear and replace when necessary
- Conduct surface current and vessel drift check

7.4 Towed operations

- Navigator and chief scientist to determine the tow plan prior to deployment of the system. The tow plan will be developed taking into account localized weather and current conditions and using the hazard maps (previously supplied by CSA for each station) to develop a tow plan that will minimize towing in close proximity to vertical obstructions (platforms) and over infrastructure (pipelines and abandoned well heads). The tow plan should be documented prior to net deployment and in cooperation with the ship's Captain.
- Maintain proper communications and coordination with back deck operations and vessel bridge
- Vessel Bridge should monitor tow path for surface and water column obstructions and hazards
- Monitor cable out (Cable Counter), seafloor depth (EK60) and towfish depth (Altimeter) in relation to the position of the towfish. Monitoring these three critical data sources should provide a good profile of where the towfish is located in reference to the seafloor
- Monitor water depth and system depth to determine proximity of towed equipment to the seafloor
- Vessel Bridge should conduct regular visual scans for marine mammals and sea turtles (see separate attachment for protocols)
- When towing transects are planned over terrain with uncertain features the minimum distance off bottom should be changed from 100m to 150m.
- Maintain a minimum vertical separation of 100m above the seafloor if no obstacles
- Raising the tow system higher than 100m above the seafloor when approaching known bottom features and structures
- Establishing a maximum tow depth of 1700m
- Monitor Simrad EK-60 (or equivalent system) bottom trace when deploying. If trace is intermittent such that a reliable water depth cannot be determined, suspend deployment until a solid bottom trace is achieved.
- During tow operations, minimize time near bottom in areas where linear infrastructure may exist.

7.5 Recovery operations

- Recover upon encountering an unsafe sea state; however, prior to deployment evaluate that conditions will be expected to remain safe for the entire tow period
- Check and prepare safety lines and winch systems

- Make sure only recovery team members in recovery area
- Communicate recovery operations to vessel bridge
- Tie in MOCNESS frame once on deck
- Secure stern safety line

8 Emergency response to equipment failure/loss

Contacting Seafloor obstacles and Loss of deployed equipment

The towed MOCNESS system may become fouled by objects, either on the seabed, or within the water column. This equipment may subsequently be so entangled that the tow cable may part, resulting in loss of the equipment. The procedure for fouling and possible equipment loss is as follows:

- The first person (usually the winch operator) to notice increased cable tension, indicative of fouled equipment, shall order all potentially exposed personnel to stand well clear of the tensioned cable
- The winch operator and CSA ops lead shall, once the safety of personnel is established, immediately notify the bridge to this effect.
- A request shall immediately be given to the bridge requesting the vessel to immediately stop (if it has not already done so)
- The bridge shall comply with this message only in so far that it is safe to do so
- The winch operator shall then start paying out cable from the remote control in order to release tension on the towed equipment.
- The vessel shall then, in the case of towed equipment, if safe and upon retrieval of other deployed equipment, if any, come astern whilst the cable is retrieved making sure it is not looped into the propellers.
- The equipment shall then be attempted to be retrieved.
- If this is not possible, then the cable shall be parted manually once it has been made safe
- Under no circumstances should the cable be put under excessive tension to try release the equipment.

It may be the case that the equipment is fouled with the cable parting before any action can be taken. It's imperative that ALL personnel at all times keep a safe distance from any deployed cables. In the event that the equipment is lost the following procedure shall take place:

- The on shift operations lead upon noticing the parted cable shall immediately check for any injured personnel
- He shall then immediately notify the bridge that the tow cable has parted and that they should immediately stop.
- The bridge shall comply with this request as long as it is safe to do so.
- The Navigator shall immediately note the last known position of the tow fish.
- Once the ship has stopped (with propellers in neutral) the slack cable shall then be immediately retrieved.

An audit shall immediately be taken to try understanding the nature of the incident to see:

- Whether there was any injury to personnel
- What caused the parting,
- Whether third party infrastructure was caught and possibly damaged,
- If so, what measures need to be taken to notify such a party
- The possibility of retrieving lost equipment.

Loss of vessel power and/or steerage

In the event that the ship should lose engine power or lose control of steering, ALL personnel shall maintain a safe distance from any deployed cables and proceed with the following:

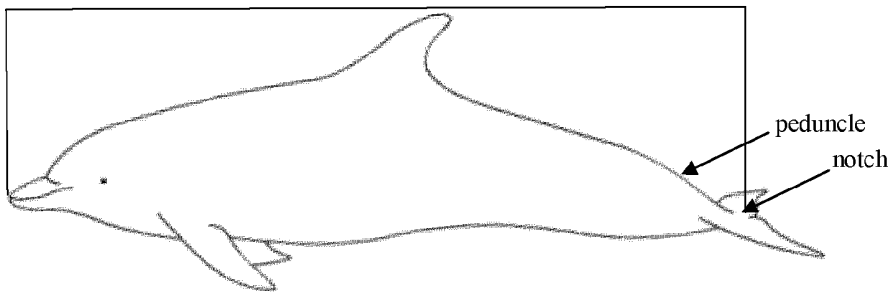
- The on shift operations lead upon noticing the loss of steerage or vessel power shall immediately check with the vessel Captain on the status of the situation.
- The winch operators will immediately begin spooling wire on the winch and begin recovery operations.
- Because the vessel has lost power and/or steerage it is a good possibility that the towed system will drop through the water column with the possibility of imminent seafloor contact. The Navigator shall immediately note the last position of the vessel.
- Wire should continue to be spooled onto the winch as quickly as possible to recover the system and all personnel shall be on the lookout for increased cable tension and the possibility of hooking the system on an underwater obstruction.

NMFS' PROTOCOL FOR DEAD ENTANGLED SMALL CETECEANS

In the event of a small cetacean mortality that is incidentally captured, please document the following items:

1. Latitude and longitude of entanglement.
2. Photograph entire animal before removing from gear (with a scale bar if possible).
3. Photograph lateral view of dorsal fin (for photo-identification) with no gear (with a scale bar if possible).
4. Measure standard length (from tip of upper jaw to notch in the tail; see picture below).

Standard length



5. Photograph ventrum, including genital slits so sex can be determined (with a scale bar if possible).
6. After removal of gear, photograph any obvious signs of net impressions/lacerations or rope wounds (with a scale bar if possible).
7. Document where in the gear the animal was entangled/caught and how gear was wrapped around animal.
8. Document reason dolphin could not be hauled aboard the vessel.

Compiled by: Barbie L. Byrd, NNFS/SEFSC, Beaufort, NC and Stacey Horstman, NMFS/SERO, St. Petersburg, FL

Sea Turtle Resuscitation Guidelines

If a turtle appears to be unconscious or comatose, attempt to revive it before release. Turtles can withstand lengthy periods without breathing; a living comatose sea turtle may not move, breathe voluntarily, or show reflex responses or other signs of life. In other cases, a lightly comatose turtle may show shallow breathing or reflexes such as eyelid or tail movement when touched. Use the following method of resuscitation in the field if veterinary attention is not immediately available:

- Place the turtle on its plastron (lower shell) and elevate the hindquarters approximately 15 - 30 degrees to permit the lungs to drain off water for a period of 4 up to 24 hours. A board, tire or boat cushion, etc. can be used for elevation.

- Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the carapace and lifting one side about 3 inches, then alternate to the other side.

- Keep the turtle in the shade, at a temperature similar to water temperature at capture. Keep the skin (especially the eyes) moist while the turtle is on deck by covering the animal's body with a wet towel, periodically spraying it with water, or by applying petroleum jelly to its skin and carapace. Do not put the turtle into a container with water.

- Do not put the turtle on its carapace (top shell) and pump the plastron (breastplate) or try to compress the turtle to force water out, as this is dangerous to the turtle and may do more harm than good.

- Periodically, gently touch the corner of the eye or eyelid and pinch the tail near the vent (reflex tests) to monitor consciousness.

- Sea turtles may take some time to revive; do not give up too quickly. Turtles that are successfully resuscitated benefit from being held on deck as long as possible (up to 24 hours) to fully recover from the stress of accidental forced submergence.

- Release successfully resuscitated turtles over the stern of the boat, when fishing or scientific collection gear is not in use, the engine is in neutral, and in areas where they are unlikely to be recaptured or injured by vessels. A turtle that has shown no sign of life after 24 hours on deck may be considered dead and returned to the water in the same manner.

NMFS/SEFSC Photos

References:

Federal Register, December 31, 2001. Government Printing Office, Washington DC 66 (250), pp. 67495- 67496.

July 2009

Protected Species Interaction Prevention Procedures for No-impact Gear Types

For data collection efforts involving a number of gear types that are routinely deployed for measuring physical properties of the ocean or collecting plankton samples, the trustees and BP have determined that there will be no effect on protected species (endangered and threatened species, and marine mammals) under the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA) if deployed according to standard protocols.

Endangered and threatened species considered to potentially occur in the sampling area.

Common Name	Scientific Name	Status
leatherback sea turtle	*Dermochelys coriacea*	endangered
loggerhead sea turtle	*Caretta caretta*	threatened
Kemp's ridley sea turtle	*Lepidochelys kempii*	endangered
green sea turtle	*Chelonia mydas*	threatened
hawksbill sea turtle	*Eretmochelys imbricata*	endangered
sperm whale	*Physeter macrocephalus*	endangered

In depths greater than 200 m, Kemp's ridley, green, and hawksbill sea turtles are expected to occur in such low abundances that they are discounted from any potential effects occurring to these species. Leatherback and loggerhead sea turtles, and sperm whales are considered further for potential adverse effects. In addition, non-listed species of marine mammals are also considered for the potential of incidental capture and entanglement occurring,

These gear types considered for their potential to incidentally capture or entangle protected species include:

- CTD and rosette samplers and instruments attached to these arrays
- Radiometers
- Bongo nets
- Neuston nets
- Vertically deployed or towed imaging systems
- 1m MOCNESS
- 10m MOCNESS

CTD and rosette samplers (with associated instrument packages) and radiometers are typically deployed in a vertical cast. The instruments are deployed on a cable and have no loose lines or other entanglement hazards for protected species.

Bongo nets are typically deployed on a cable down to a depth of up to 200 m and neuston nets are deployed in the upper 1 m of the water column. The small size of these nets (neuston net 2 square meters, 2 bongo nets of 0.5 square meters each) and the lack of a loose line makes the likelihood of capture or entanglement of a marine mammal or sea turtle exceedingly small. In more than two decades of the SEAMAP program conducting bongo and neuston tows, no incidental captures of marine mammals or sea turtles have occurred.

Imaging systems such as the Digital Automatic Video Plankton Recorder (DAVPR) are either lowered vertically through the water column or towed on a conducting cable. The overall footprint of the instrument package is small and the wire is kept tight for proper deployment. No loose lines are present.

Neuston net – 2square meters
Bongos are each ½ square meter for a total of 1 square meter
Manta Neuston net – approximately 0.5 square meter

1m MOCNESS and 10m MOCNESS nets are deployed up to 2000m or more in depth (typically targeting 1500m). The net system is mounted on a rigid frame and no loose lines are hanging in the water. Although larger than bongo and neuston nets, these nets are still relatively small and only sweep a very small percentage of the water volume. The heavy, rigid frame results in a sinking rate of approximately 20m/s and thus the net is descending through the upper water column quickly. The nets are towed at 1.5 to 2.5 knots and tows last about 4 – 6 hours. Thus, for the 10m MOCNESS, the average volume swept in a deployment (assuming 1500m descent and a 5 hour tow at 2 knots) is approximately 215,000 cubic meters of water. Since sampling stations are on 30 nautical mile centers, the percentage of volume swept by a 10m MOCNESS, not including the volume below 1500m is 0.0000046% or approximately 1 in 215,165. Given that the most abundant turtle species, the leatherback has approximately 1 animal per 417 sq km of ocean in waters greater than 200m depth, if it is assumed that this density remains the same for waters in excess of 1500m, there are approximately 7.4 leatherbacks per 30 nm x 30 nm cell. Thus, if the animals were randomly distributed within the water volume and did not move, the probability of capturing one in the 10m MOCNESS is 1 in approximately 29,000 tows. Similarly, loggerheads are expected to be present at a density of about 1 animal per 500 square km and have a catch probability of 1 in 34,900 tows. However, since much of the tow time of the MOCNESS net is well below the foraging depth of turtles, the probability of capture is in fact, much lower.

Although a no impact determination on endangered species from these gear types has been made, and the likelihood of capture or entanglement of marine mammals in these gear types is exceedingly small during the deployment and retrieval of the nets from deep water tows, the following mitigating measures will be taken to assure that potential interactions with protected species are minimized to discountable levels.

1. **Marine mammal and sea turtle observers.** Prior to deploying any sampling equipment, at least one observer shall be established to keep dedicated watch for marine mammals and sea turtles. The observer's sole purpose shall be to scan for marine mammals or sea turtles, with a focus of monitoring 180 degrees in front of the vessel's course, prior to the deployment of sampling gear. Since the intent of scanning for marine mammals and turtles is to assure that the gear is not deployed if marine mammals or turtles are shipside, a visual scan of the deployment area should be conducted for at least 30 minutes prior to deploying sampling gear. During night deployments night-vision binoculars or deck lighting with the naked eye may be used for monitoring. If marine mammals or turtles are observed in the vicinity of the vessel, deployment of sampling gear should not occur until protected species are verified to be clear of the area, or if not resighted, 30 minutes

after the initial sighting, until the chief scientist, in consultation with the captain deem that it is safe to do so.

2. **Keep all cables tight on sampling gear.** Protected species may become entangled in loose lines associated with sampling gear. Dolphins are known to become entangled in lazy lines on shrimp trawl nets, float lines of trap/pot gear, and buoy lines of gillnet gear, etc. Although none of the gear types under consideration here have lazy lines or other rope types, and cables are unlikely to entangle protected species, lines should not be allowed to become slack.

3. **If protected species are observed during sampling.** It is possible that marine mammals or turtles will be observed after sampling gear has been deployed but before sampling is complete. Given the small size of nets, the slow ship speeds, and the other factors outlined above for these sampling gears, any injurious interaction between the sampling gear and a turtle or marine mammal is still extremely small. However, if an observation is made while gear is in the water, the proximity of the observed animal to the sampling gear should be closely monitored and the gear should be removed from the water if there appears to be any potential for capture or entanglement.

If a protected species take occurs, the following measures shall be conducted:

1. **Report any marine mammal capture/entanglement immediately.** Marine mammal entanglements (live or dead) must be reported immediately to 1-877-WHALE HELP (1-877-942-5343).

2. **Report any sea turtle capture/entanglement immediately.** Immediately report any sea turtle takes to takereport.nmfsser@noaa.gov or Bob Hoffman at the NMFS Southeast Regional Office (727-403-2641). In the event of any unauthorized takes of sea turtles, sampling should cease until the harm avoidance measures can be reviewed with NMFS Southeast Regional Office, Protected Resources Division, and modified as needed.

3. **In the event of a live animal capture/entanglement within sampling gear,** work from the vessel as quickly and carefully as possible to disentangle the animal for prompt release. Ensure the marine mammal's blowhole and sea turtle's mouth are kept at the surface to ensure it can continue to breathe while disentangling. If possible, the animal shall be identified, photographed, and released directly back into the water to avoid further injury from being brought aboard the ship. If the animal is not able to be released directly back into the water, the animal and sampling gear shall be carefully placed on the deck of the ship, preventing the animal from falling on the deck and becoming further injured. For turtles, follow the turtle resuscitation guidelines (attached). For marine mammals, ensure the animal's blowhole is free of obstructions and work quickly and carefully to return the animal to the water.

4. **In the event of a mortality,** the animal shall be retained and guidance shall be given on how to maintain the carcass. The Principal Investigator shall seek guidance from Wendy

Teas (305-361-4595) for sea turtles and Blair Mase (305-361-4586) for marine mammals at the NMFS, Southeast Fisheries Science Center on how to retain the carcasses (i.e., whether they should be put in the cooler and immediately brought back to shore for sampling, or frozen for future sampling). Photos, measurements, and entanglement information shall also be documented per "NMFS' Protocol For Dead Entangled Small Cetaceans" attached or a sea turtle stranding form filled out and sent to Wendy Teas. Reports should also include whether mitigation measures were followed, and if not, an explanation provided.